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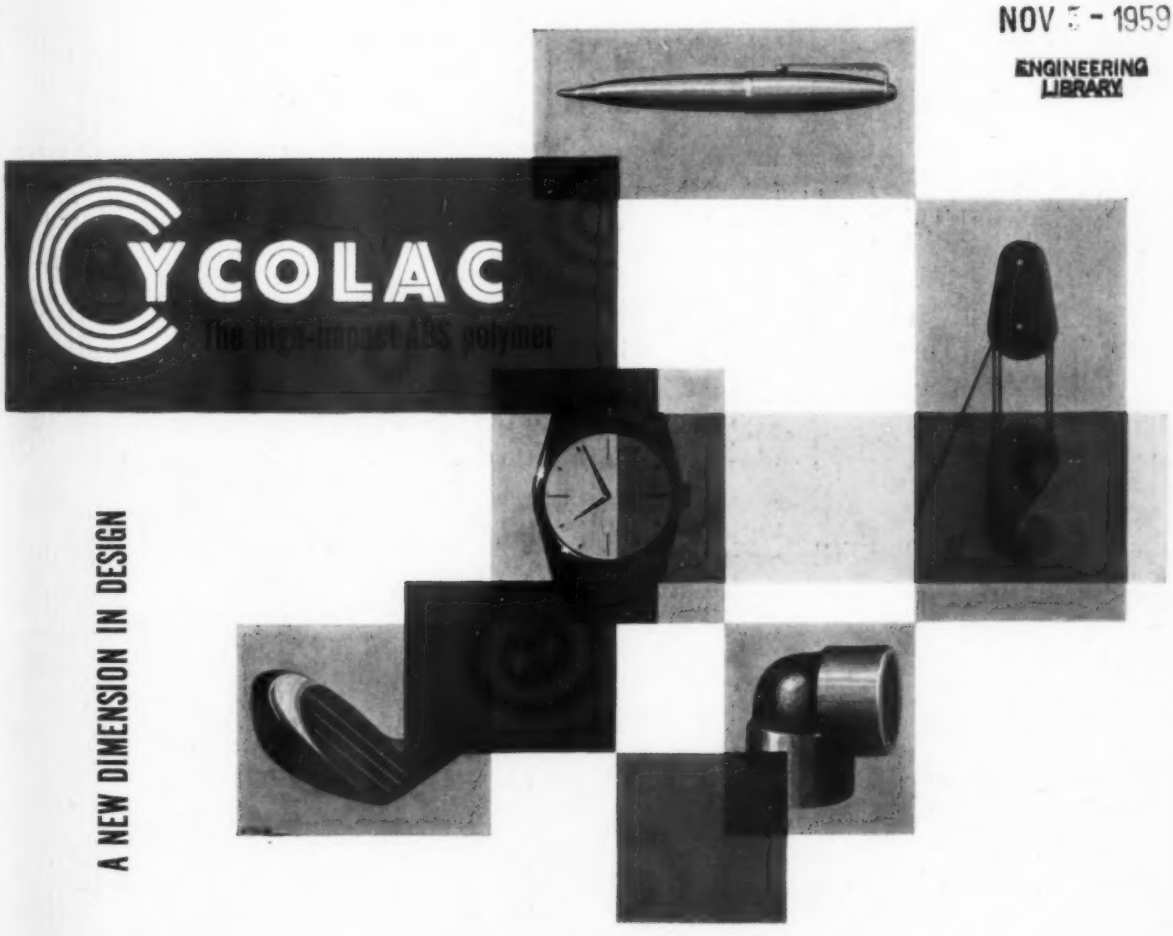

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IN ITS 76th YEAR

October 17 1959

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NOTES of the WEEK

Extra Special

ALTHOUGH, strictly speaking, this issue of *RJIP* is merely one out of the 52 issues that appear each year, it serves, in fact, a double purpose. It is our annual Export Issue and, as such, includes more technical and feature articles than could be included in a normal weekly issue. We are also taking this issue to mark the 75th anniversary of the Journal which was first published in August, 1884. Originally appearing once a month, the Journal became a weekly in 1897. In the years between, some other weekly publications in the same field have come and gone but *RJIP* remains the only weekly journal in the world serving the rubber and plastics industries. It reaches subscribers all over the world, from China to Chile; Sweden to South Africa. Illustrated and described in this issue are representative rubber and plastics products manufactured in the United Kingdom and thanks are tendered to those manufacturers who have cooperated in supplying details of their products. Also, for the first time, we are including a section on British machinery and ancillary equipment for the rubber and plastics industries.

Sondernummer

OBGLEICH, genau genommen, diese Ausgabe der R.J.I.P. (Kautschuk Zeitschrift und Internationale Kunststoffe) nur eines der 52 Hefte ist, welche jedes Jahr erscheinen, dient diese Nummer einem doppelten Zweck. Es ist dies unsere alljährliche Exportnummer und beinhaltet als solche eine grössere Anzahl technischer Artikel und solcher von allgemeinem Interesse, als in einem gewöhnlichen Wochenheft gebracht werden können. Diese Nummer steht im Zeichen des 75. Jubiläums dieser Zeitschrift, welche zum ersten Male am 18. August 1884 veröffentlicht wurde. Ursprünglich kam sie einmal im Monat heraus und ist seit 1897 eine Wochenschrift geworden. In den dazwischenliegenden Jahren sind andere Veröffentlichungen auf diesem Gebiete erschienen und eingestellt worden, die R.J.I.P. bleibt jedoch die einzige Wochenschrift der Welt im Dienste der Kautschuk- und Kunststoffindustrien. Sie gelangt zu Abonnenten auf der ganzen Welt von China bis Chile; von Schweden bis Südafrika. In dieser Sondernummer sind typische, im Vereinigten Königreich erzeugte, Kautschuk- und Kunststoffartikel dargestellt und beschrieben. Zum ersten Male bringen wir auch einen separaten Abschnitt über britische Maschinen und Zusatzeinrichtungen für die Kautschuk- und Kunststoffindustrien.

Extra

BIEN que, à vrai dire, ce numéro du R.J.I.P. (Journal du Caoutchouc et des Plastiques Internationales) soit un parmi 52 numéros paraissant dans l'année, il en a fait un double but. C'est le numéro annuel sur l'exportation, et, en tant que tel, comprend plus d'articles techniques et littéraires que dans les numéros hebdomadaires usuels. Nous avons aussi choisi ce numéro pour marquer le 75ème anniversaire de ce Journal qui paru pour la première fois le 18 août 1884. A l'origine ce fut un mensuel, et ne devint un hebdomadaire qu'en 1887. Depuis lors, d'autres publications dans le même domaine ont paru et ont cessé de paraître, mais R.J.I.P. continue toujours. C'est le seul journal hebdomadaire dans le monde déservant les industries du caoutchouc et du plastique. Les abonnés résident partout dans le monde, depuis la Chine jusqu'au Chili, depuis la Suède jusqu'en Afrique du Sud. Dans ce numéro spécial on trouve illustrés et décrits des produits en caoutchouc et en plastique fabriqués dans le Royaume Uni. Et, pour la première fois, nous comprenons une section sur les équipments accesoires et les machines britanniques pour les industries du caoutchouc et des plastiques.

Nota Speciale

SEBBENE, in senso stretto, questa edizione del R.J.I.P. è veramente una delle cinquantadue edizioni che sono pubblicate ogni anno, serve in effetti un doppio scopo. E la nostra edizione annuale per l'esportazione e, come tale, include più articoli e croniche tecniche di quante potrebbero essere incluse in una edizione settimane normale. Pubblichiamo questa edizione anche per marcare il settantacinquesimo anniversario del Giornale, che fu pubblicato per la prima volta il 18 Agosto 1884. Mentre originariamente usciva una volta al mese, la pubblicazione divenne un settimanale nel 1887; negli anni intermedi altre pubblicazioni nello stesso campo sono venute e sono scomparse, ma R.J.I.P. rimane l'unico settimanale nel mondo che serve le industrie della gomma e della plastica. Raggiunge gli abbonati in tutte le parti del mondo, dalla Cina al Cile, dalla Svezia al Sud Africa. In questa edizione speciale sono illustrate e descritte rappresentazioni dei prodotti di gomma e di plastica fabbricati nel Regno Unito. Inoltre, per la prima volta, includiamo una rubrica sul macchinario e accessori sussidiari britannici per le industrie della gomma e della plastica.

NEWS *Briefs*

POLISH PHENOL PLANT — US NATURAL RUBBER PORTUGUESE/GERMAN TRADE — INDIAN PVA FACTORY — INDONESIA — BRITISH GUIANA

●**Poland**—A large new phenol plant is under construction at Bydgoszcz. Part of it is already operating and producing between 100 and 200 tons of phenol a month. It is planned to produce eventually 13,000 tons a year. The plant is being equipped with Polish machinery and will use local raw materials.

●**British Guiana** — An interesting development in the plastics field in British Guiana is reported by Barclays Bank DCO from Georgetown. The Colony's first fibre glass boat, a 21ft cabin cruiser christened the 'Rena' has been built at a cost of $3,500. The builders Messrs. Edwin and Faisal Hamid, proprietors of B.G. Plastics Works recently returned from a two year course in the UK on the manufacture of fibre glass products. They have also built a fibre glass sports car body, kitchen sinks, drainboards and washbasins.

●**Indonesia**—The Antara news agency has announced that the Harrison and Crosfield Company would soon be re-opening its rubber estate at Labuhan Batu Regency, in North Sumatra, which was idle since July of last year.

●**United States**—A General Tire and Rubber Co. official said in Boston recently that the fiscal year ending November 30 will be the best in the company's history. At a meeting of the Society of Security Analysts, Mr M. G. O'Neill, executive assistant to the president and also a vice-president, estimated sales at 650 million dollars and net profit at around five dollars per share.

●**United States**—The Natural Rubber Bureau, in its periodical Natural Rubber News, has forecast a boom year for natural rubber in 1959. 'This is a sellers' market,' the Bureau said, 'that could continue into 1960 with one major reservation — stockpile sales.' The Bureau warned that sales from United States and British stockpiles could add 60,000 to 70,000 tons to natural rubber supplies. Mr H. C. Bugbee, president of the Bureau, estimated fourth quarter sales from United States and British stockpiles would be 20,000 tons, based on disposal of 16,000 tons by the United States and 4,000 by Britain, which was 'admittedly highly conjectural at this point.' 'Depending on the degree of balance between production and consumption,' the magazine said, 'this stockpile tonnage will either lower 1960's estimated world stock deficit substantially or could even swing supply in excess of demand.' Mr Bugbee estimated world rubber consumption in 1959 would total 3,550,000 long tons of all rubbers. Of this 2,050,000 would be natural and 1.5 million tons synthetic.

●**India**—The Farbwerke Hoechst Indian subsidiary, Hechst Fedco Pharina Put. Ltd., of Bombay, has been granted Indian Government permission to manufacture polyvinyl acetate emulsion at its Bombay plant at an annual capacity of 2,400 tonnes.

●**United States**—US plastics production this year will reach 6,000 million lb., Mr R. C. Weigel, President of the Society of the Plastics Industry, predicts. Mr Weigel told a meeting of the New England section of the Society that production so far this year was running 25 to 30% ahead of 1958. He forecast that output would continue to rise, reaching 8,000 million lb. in 1965. In the meantime, the US Industrial Chemicals Co., Division of National Distillers and Chemical Corporation, too announced plans for a further increase of 50,000,000lb. in productive capacity of its polythene resin plant in Houston, Texas. This would bring the capacity to 200,000,000lb. annually. When the expansion was completed by mid-1960, the firm's total capacity (including a plant in Tuscola, Illinois) would be 300,000,000lb. annually, the announcement said.

●**Portugal**—The text has recently been released of a Portuguese-German Trade Agreement covering trade between Metropolitan Portugal and the Portuguese Overseas Provinces and the Federal Republic of Germany for the period from April 1 1959 to March 31 1960, which was concluded on June 2. Among the non-liberalized goods to be exchanged are (from Germany) rubber manufactures, tyres and inner tubes.

●**United States**—A 4% increase in prices of vinyl film and sheeting materials has been announced by the Goodyear Tire and Rubber Company. The increase covers regular vinyl film and the company's 'Plihoyde' which is used among other things as a wall covering. The company said that the increase resulted from 'recent advances in costs of labour and raw materials.' It is to be effective on shipments after October 28.

'It's a good one! Try to cast your mind back—What happened?'—454

Forward into 1960

CHALLENGE AND OPPORTUNITY FACE RUBBER INDUSTRY

By D. E. CAMERON

AS we move forward into 1960 and onward into the last part of the 20th Century, a growing challenge and opportunity confronts the British Rubber Manufacturing Industry.

Unfortunately, the countries of the European Common Market found themselves unable to agree with the proposals put forward by Britain for a European Free Trade Area. At the time of writing it is very likely that an organization will come into being of the 'Outer Seven' to be called 'The European Free Trade Association.' It seems to me that one of the principal underlying factors of the resistance to Britain's proposals for a European Free Trade Area was, in part, historical.

There is still abroad, in some minds, the feeling that the British, as a race, are extremely skilful negotiators and that we do not by any means always 'put all our cards on the table.' Therefore, these people argue, if we agree with the British proposals, even if we cannot see it now, we shall find in the long run that we are 'holding the thin end of the stick' and that this will be yet a further example of 'perfidious Albion.'

In helping to overcome this feeling among some people abroad, one of our national characteristics does not help. As a race we are apt, in conversation, to play down our achievements and to unduly criticize our faults. As some supporting evidence for this, I well remember being told by a Canadian that after he had been in this country for 10 years he would have been completely convinced if he had only listened to conversations with men and women in many different walks of life up and down the length and breadth of the country that Britain was finished as a great power; that we had the worst possible kind of Government, etc. It is worthwhile remembering that those years were from 1893 to 1903 and all our country's great achievements in the first and second World Wars, and in industrial and scientific progress, were still to come.

This self-critical attitude can be a great strength inside our own country, but it seems to me that it is so often misunderstood and misinterpreted by other nations. I am sure any of us who have been out trying to sell in the export field have found that this is so and have had to take steps to counteract it.

As we march forward into association with the other countries of the European Free Trade Association (Outer Seven), we have the great challenge and opportunity of demonstrating, not only to those countries, but to the world, that the great British trading nation is very surely a partner worth having, and in fact is indispensable to any free association of nations.

In other words, by our performance within the European Free Trade Association (Outer Seven), not only shall we be judged by our partners in that group, but we shall also be judged by the nations within the European Common Market.

In forming the European Free Trade Association it is, I am sure, the hope of all the partners in that Association that this, in due course, will lead to some type of larger Free Trade Area, in association with the countries of the European Common Market. If therefore, in the years to come, we are to have such a European Free Trade Area, in association with the European Common Market (possibly something very akin to the proposal made by our statesmen in Paris last year), and we in industry feel that this is something we should have, then we must remember that a very great deal will depend on how all of us engaged in industry carry out our special responsibilities in our efforts to foster two-way trade with our partners in the European Free Trade Association, namely, Denmark, Finland, Norway, Portugal, Sweden, Switzerland.

In other words, it is vitally important that we should do everything in our power to make the EFTA the greatest possible success.

So far we have been considering our responsibilities as part of British industry, but let us consider our own British rubber manufacturing industry. I will not comment about the exports and imports of tyres and tubes, as that is a part of the Industry of which I have little or no knowledge; except to say that in general, the same principles apply to that great part of our industry as to the manufacture of general rubber goods.

We have to consider both exports as well as imports. Looking at exports first of all, and our Industry's performance in the first half of 1959, we find the figures were as in Table 1.

When we come to consider 1958, the total export figures of General Rubber Manufacturers for the whole of that year amounted to £17,826,205, and the percentages were as quoted in Table 1.

It is, of course, dangerous to argue from only six months figures for any year against a whole year's performance, but the trends are something

THE AUTHOR

DONALD EWEN CAMERON, M.A., is chairman and managing director of B.B. Chemical Co. Ltd. and a director of the British United Shoe Machinery Co. Ltd. He takes a great interest in, and devotes much time to, the affairs of the rubber industry and is a member of the executive committee and the council of the Federation of British Rubber and Allied Manufacturers and is a past vice-president of the Federation. He is chairman of the British Rubber and Resin Adhesive Manufacturers' Association and is also chairman of the Federation's Import Policy Study Group.

that we must bear well in mind. For instance, our percentage of exports from the first six months of this year to our partners in EFTA has dropped from 10.9% for the whole of 1958 to 10.1% for the first half of 1959.

TABLE 1

EXPORTS OF GENERAL RUBBER MANUFACTURERS

To	*First Half* 1959 £	*% of Total*	*% of Total* 1958
Our partners in the EFTA	939,853	10.1	10.9
Common Market countries	1,271,722	13.6	14.3
British Commonwealth of Nations ..	3,327,806	35.9	44.5
The rest of the world	3,767,002	40.4	30.3
Total	£9,306,383	100%	100%

TABLE 2

IMPORTS OF GENERAL RUBBER MANUFACTURERS

From	*First Half* 1959 £	*% of Total*	*% of Total* 1958
Our partners in the EFTA	110,835	2.7	1.3
Common Market countries	1,389,949	34.6	41.7
British Commonwealth of Nations ..	1,983,320	48.7	51.2
The rest of the world	578,388	14.0	5.8
Total	£4,062,492	100%	100%

These percentages, I hope, may be corrected when we have available to us the whole of our export figures for 1959, but already the first six months surely give us a warning that we must intensify our efforts for export, not only to the countries of the European Common Market, wherever we possibly can, but particularly to our partners in EFTA.

Now we must have a look at the import side of the picture, because if we are to play our part in EFTA we have got to realize that what are imports to us are exports by our partners in the EFTA and, therefore, will have to be encouraged even more in future than they have been to date. The figures are as in Table 2.

During the whole of 1958 our total imports of General Rubber Manufacturers amounted to only £5,829,682. Thus our imports in the first six months of 1959 were at a much greater rate than they were for the whole of 1958. The percentages of our imports for 1958 are given in Table 2.

Here we find that the right trend *vis-a-vis* our partners in EFTA is already being demonstrated in the first six months of this year, as during that period 2.7% of our total imports came from those six countries, as compared to only 1.3% when looking at our figures for the whole of 1958.

It seems to me, therefore, from what I have said above, and from the pattern of our figures for export and import, that the challenge and the opportunity that awaits us is to help to stimulate the use of our products throughout the area of EFTA, as well as within our own country, that we shall be able, at the same time, both to increase our own exports of rubber manufactured goods, while maintaining a steadily rising level of imports from our partners in the European Free Trade Association.

Here is an opportunity in front of us all to play our part to establish in the eyes of the world, and particularly in Europe, that our country is not only a very valuable ally to have in war time, but is an equally valuable ally in the industrial sphere, even although it is vitally necessary that Britain should maintain her special relations with her partners in the British Commonwealth of Nations.

Dunlop Footwear Expansion

Dunlop Footwear Ltd. are spending £150,000 on the expansion of their new factory at Walton into which they recently moved. This expansion will embrace the increased production of directly moulded footwear, and also standard lines.

A feature of the operation is the establishment of a new technical centre, in which will be concentrated long term development projects, with pilot plants for the evaluation of new ideas and processes on a semi-production scale. Among the long term projects, a new process for the direct vulcanization of microcellular rubber to both leather and canvas uppers has already been completed.

Head of the new department is Mr F. Baynes, who has been with Dunlop for 20 years and since 1952 has been closely connected with the Footwear Company.

Reinforced Polythene Film

Already extensively used in papers to provide tougher wrappings and coverings, 'Fiberglas' reinforcement has now been extended to another covering material, polythene film. Introduced by Chemicals Trading Co. Ltd., of Cree House, 18-20 Creechurch Lane, London, E.C.3, and marketed under the name of 'FRF,' the material clearly has a great number of potential uses ranging from bulk packaging for foods and chemicals, on building sites, for temporary silos, hay stacks to cold frames and greenhouses.

'Rigidex' high-density polythene, produced by British Resin Products Ltd., Devonshire House, Piccadilly, London, W.1, is being used by G. Harrison Ltd., Ruthin, Denbighshire, in the production of 'Full Sail' scourers

Prospects of Expansion in the Plastics Industry

EXTENDED APPLICATION OF RAW MATERIALS

By C. H. GLASSEY

IN attempting a review of the general prospects of the Plastics Industry I referred, first of all, to the comprehensive survey made by Mr H. V. Potter which was published in the RUBBER JOURNAL AND INTERNATIONAL PLASTICS as recently as November of last year.

This dealt exhaustively with the relative prospects of expansion in the respective fields of thermosetting and thermoplastic resins and moulding materials, and the conclusions based on statistics graphically expressed have been, as was to be expected, confirmed by subsequent events.

It is symptomatic of the inherent strength of the industry that, although it shared in the slight recession common to all industry which affected the latter part of last year, it responded immediately to the general increase in industrial productivity. There is no evidence that its plans for future expansion have been halted and, in fact, overall production and sales have shown a marked increase in recent months.

In the foreseeable future it is unlikely that there will be any significant change in this trend of development, and I felt it desirable to put more emphasis at this juncture on those complementary activities of the plastics industry which are of such vital importance if the ever increasing volume of plastics raw materials is to be economically processed in competition with older and more conventional materials.

Within the plastics industry itself, in both the home and export markets, there is evidence of increasing competition, and in the export markets in particular the full effect of European integregation has yet to be felt, making an accurate assessment of the future price structure most difficult at this juncture.

This aspect has put emphasis on problems of mechanization designed to give improved semi-automatic, fully automatic or continuous processes for the moulding and laminating sections of the plastics industry.

In the thermosetting section of the moulding industry it was usual, only a few years back, to think of time cycles in terms of minutes, whereas now it is essential to operate time cycles in terms of seconds.

Plant and machinery used in the manufacture of plastics raw materials which are substantially the products of chemical reactions, have, in the main, been based on a sound background of plant technology evolved over years, suitably modified to meet the special requirements of new formulations. The basic principles of construction, however, remain unchanged.

Machinery used in the moulding and fabricating of plastics raw materials had no such background of knowledge upon which to build a new industry, and in the early days of the moulding industry the press equipment deployed was, to all intents and purposes, the conventional types used in the rubber industry.

To an even greater extent, the expansion of the moulding industry has been faced with the problem of acquiring the technique of mould design, which today constitutes such an essential factor in competitive moulding.

To achieve the optimum economies from semi-automatic or fully automatic moulding operations the problems of press design and mould design are one and indivisible, and even at this stage of evolution there remains a profitable field for further development work.

The increasing impact which the plastics industry is making on the steadily increasing markets for consumer goods necessitates more and more concentration on product design to ensure that aesthetically the mouldings produced from tools of modern design are acceptable to a discriminating public.

Fortunately for the future of the industry these vital problems have long been recognized, and as a result of excellent work done by The Plastics Institute in the United Kingdom, and comparable organizations in many other countries, adequate facilities for training have now been established, and exchange of technical information is becoming more readily available to students and trainees as a result of collaboration between these various organizations. Financial support for this educational effort has been given by the industry itself, while The British Plastics Federation, working through its various technical committees, gives constant guidance and ensures co-ordination and con-

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THE AUTHOR

CHARLES HENRY GLASSEY, F.P.I., is Chairman of the British Industrial Plastics Ltd. Group of Companies and of all its subsidiaries. He has been actively engaged with the company (formerly known as The British Cyanides Co. Ltd.) since he joined it in July 1907.

He continues to take a keen interest in the two organizations which serve the plastics industry — The British Plastics Federation, of which he is the current President, having served as Chairman of many of its Committees during the years 1943-49, *and The Plastics Institute, having been the first Chairman of the Midlands Section in* 1932 *and* 1933, *Chairman of Council in* 1934 *and is now a Vice-President. He was Deputy Controller of the Plastics Control of the Ministry of Supply from* 1939 *to* 1943.

Mr Glassey was elected a member of the Worshipful Company of Horners in the spring of 1951 *and joined the City Livery Club in* 1958. *He is a Fellow of the Institute of Directors.*

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tact with appropriate Government sponsored associations.

Laminated Plastics

To an increasing degree, laminated plastics are being used in the fields of interior decoration and furniture, both domestic and office equipment.

Here again the emphasis is on continuous processes of manufacture, coupled with the demand for decorative finishes in colour and pattern which enhance sales appeal without any diminution of the basic technical properties of the laminates.

A complementary development in this field is the constantly expanding production of building board based on the bonding of discrete particles with synthetic resins, which again calls for some form of decorative finish incorporating plastics formulations.

Thermoplastic Resins

Expansion in the use of thermoplastic materials is still the outstanding feature of the plastics industry as a whole.

With the insistent demand from the public for attractive and hygienic packages this expansion should continue for the foreseeable future, particularly so as no satisfactory alternative product has as yet been developed.

Similar progress is evident in the synthetic fibre industry, where recent research and development work would appear to be devoted less to increasing the number of chemical formulations as to the improvement of existing ones to provide special finishes and embody certain of the more important properties of natural fibres.

It is a feature of the thermoplastic resin industry that every addition to, or duplication of, plant required in its manufacture constitutes, of necessity, a very substantial tonnage of material for which markets must be found, and this factor, should it get out of balance could, temporarily at any rate, adversely affect the economics of the situation.

A study of current technical literature on this subject indicates that there are developments 'round the corner' in the thermoplastic field which envisage products having exceptional properties which could lead to their application impinging upon the use of certain metals for which plastics materials have not hitherto been suitable. If the amount of capital which is being invested in these developments is any criterion, it is reasonable to assume that there exists considerable confidence that the objectives will be achieved and the effects on the future of the industry could be far reaching.

Structural Plastics

In the thermoplastic field structural plastics probably constitute currently the widest field of potential development.

The combination of synthetic resins with glass fibre gives a material of outstanding merit for the provision of improved lighting of buildings of all types. Sheet material so produced not only provides optimum light transmission but a high degree of resistance to shatter, and grades possessing self-extinguishing properties minimize fire hazards.

In general construction work, moulding compounds based on synthetic resins, combined with glass fibre or other selected fillers, both organic and inorganic, are being employed to a steadily increasing extent in boat building, car bodies, chemical plant and the electrical and allied industries. The opportunities for expansion in these fields have, as yet, only been touched upon, but envisaging as they do components of a size far larger than can be achieved in quantity from existing press and mould resources, it is inevitable that there will be a growing demand for larger presses of specialized construction incorporating press tools so designed as to ensure rapid production of fault-free components.

Some comparison may be drawn with the early days of the automobile industry, when hand fabrication of car bodies and components was common practice, having resemblance to the 'hand lay-up' methods now deployed in structural plastics fabrication.

At some stage in the possibly not too distant future consideration will have to be given to a very considerable capital investment if this development of the plastics industry is to expand to the full.

In the intervening period realization of these forecasts must depend upon the properties claimed for structural plastics being confirmed by their behaviour under lengthy service conditions, and sufficient experience has already been gained to justify cautious optimism in this connexion.

Conclusion

Taking into consideration all the known factors of the present state of evolution in the plastics industry, I suggest that it is reasonable to assume that to that same degree as the chemical engineer has enabled the work of the research chemist to be translated into commercial production so will the mechanical engineer now be called upon to extend the application of plastics raw materials into the wider fields of endeavour envisaged.

Rapid Cycle Moulding

RESEARCH WORK COMMISSIONED AT PRI

A PROGRAMME of research work on rapid cycle moulding technique as applied to thermosetting plastics materials has been commissioned by Radio Heaters Ltd., to be carried out by the Plastic Research Institute at Delft, Holland.

The company state that they commissioned the programme concerned as they felt that although they had already issued a considerable amount of information on the great increase in productivity possible with this new technique, formal research into rapid cycle moulding would be helpful in order to provide the practical moulder with authoritative independent information on such questions as press closing speed, platen temperatures, pre-heating temperatures and speeds, also confirmation that very rapid operating cycles did not affect the completeness of the cure, together with indications of any points which should be watched for, in introducing the new technique.

The research programme into rapid cycle moulding will be under the supervision of Mr Bartoo. The work will be carried out on a 5kW. 'Radyne' pre-heater. It is hoped that in addition to giving moulders all over the world authoritative information on the technique the work will also give a lead as to the best lines for future research into plastic pre-heaters. The fundamental research programme is being carried out on phenolic moulding materials, cross checks will, however, be carried out on urea and melamine, in order to make sure that the basic information obtained on the behaviour of the phenolic materials can be applied under practical moulding shop conditions to both urea and melamine.

It is anticipated that the research programme will be completed in the early part of 1960. The report describing the results of the programme will be made available to all thermoplastic moulders in due course.

Mr A. Noble and Mr F. Noble have been appointed to the board of the RFD Co. Ltd., Godalming, Surrey.

Printing Calendered PVC

MODERN DEVELOPMENTS AND METHODS

By THOMAS B. PYE

SHORTLY after the last war a new material began to make an appearance in the field of coated fabrics and allied trades, which had many possible outlets and was too important to be ignored. This material was calendered polyvinyl chloride film and sheeting. It was a natural development that this material should be decorated by printing, a development which presented a challenge to Storey Brothers and Co. Ltd. In Lancaster were virtually all the tools for the job. Here was practically the whole history of photogravure etching and printing, long established design and photographic studios and calender know-how. Storeys of Lancaster were proud that the firm which first made possible the commercial application of photogravure should once again be to the forefront in photogravure development, namely the printing of calendered PVC.

It was soon evident that very fine quality etched and engraved printing cylinders were going to be needed. Consequently, new buildings were erected to house modern equipment. Printing inks were to be an important link in the chain. Therefore, a new ink manufacturing plant was erected and a battery of pebble mills installed. Existing printing machines were modified as ink development progressed. Meanwhile, printing machine engineers had begun to build equipment both in America and Europe specifically designed for PVC.

Some ten years later printed PVC of all gauges and for many end uses was entrenched in the world markets, and the demand upon the skills of the cylinder maker, the ink chemist and the printer has continually increased.

THE AUTHOR

THOMAS BARTON PYE was born in Penwortham, Lancashire, in 1918. *He was educated at Balshaw's of Leyland and from there joined the Laboratories of the British Tyre and Rubber Company. He remained with that company until* 1948, *apart from the war years, when he served with the army commanding a waterborne assault company as a Major in the Far East.*

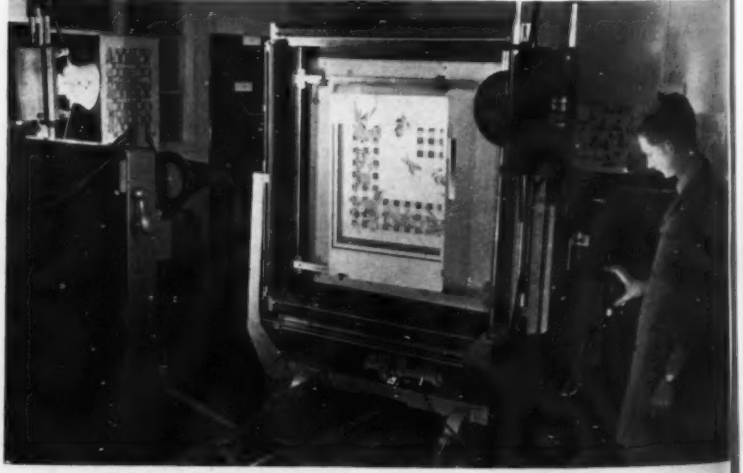
He joined the staff of Storeys of Lancaster in 1950 *and was appointed production manager in* 1955. *In this capacity he has been closely concerned with the many developments and production problems associated with the manufacture of polyvinyl chloride film and sheet, and the subsequent decorative and converting processes.*

The Processing of Printing Cylinders

New designs for the decoration of PVC are usually selected by those in touch with current market trends. Designs so chosen are then discussed with the chief designer, photogravure manager and printing manager, who consider how best the cylinders should be made to reproduce the pattern faithfully. Following these deliberations the finalized design is received by the photogravure department whose responsibility it is to etch the designs on to the copper cylinders.

The size, number of colours and number of repeats of the design having already been decided, the job is handed to the planning section who prepare separation positives—one for each cylinder. Each positive consists of an accurate reproduction by photography or art work or combination of both on transparent film. Accuracy is essential and all the positives must fit each other exactly when each setting-out mark is placed in register.

The complete positives are now ready for printing down on carbon tissue (or pigment paper) which in turn will be used to transfer the image of the design to the copper cylinders. This carbon tissue has to be made light sensitive by dipping in potassium dichromate solution for a predetermined time a few hours before it is required. The dried sensitized tissue is then cut to size and exposed through a photogravure screen in a vacuum printing frame to the light of an arc lamp. The purpose of this screen, which is composed of a pattern of square dots separated by transparent lines, is to break up the etched design on the copper cylinder by a series of cross-lines. Photogravure screens can have rulings from 80 dots to 200 dots per inch. For PVC sheet-



Original design being photographed with process camera

ing the coarser, 80 to 120 rulings are most suitable.

After exposure through the screen the carbon tissue is again exposed through the positives. This can be done with a vacuum frame or on a step and repeat machine if the finished design is composed of a series of pattern repeats. The image of one colour is now ready to be transferred to the copper cylinder already ground to size and highly polished.

After checking that the register marks on the carbon tissue are in the correct position in relation to the cylinder, transfer is effected by feeding the carbon tissue between the cylinder and a heavy rubber roller, which are both revolved at the same time, a fine stream of water being played between the gelatine tissue surface and the copper surface. After one revolution, the pressure roller is removed leaving the carbon tissue adhering to the cylinder which is then slowly revolved partially immersed in warm water at 100°F.

Developing Begins

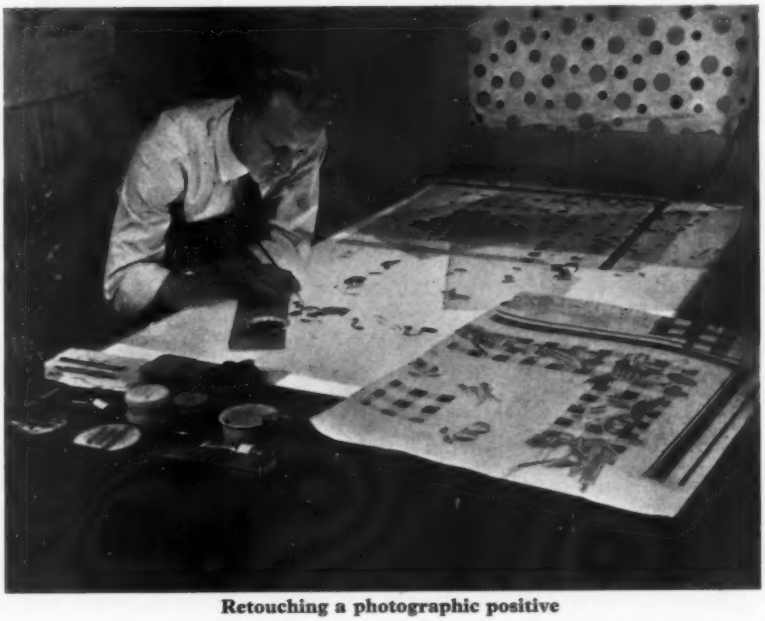
When the backing paper peels away, leaving the pigmented gelatine on the cylinder, the water temperature is raised to 115°F. and developing begins. The gelatine now dissolves where light from the arc lamp did not reach the carbon tissue in the second exposure, and the exposed portion being insoluble remains on the copper. The roller is then cooled with water, dried with methylated spirit.

After the dry gelatine resist has been checked for register and blemishes, the unprotected portions of the cylinder are painted with an etch resistant lacquer to prevent etching of the non-printing areas. The cylinder is then ready for etching with ferric chloride solution.

The cylinder is now revolved in the ferric chloride solution which penetrates the gelatine resist and attacks the copper, the speed of penetration being controlled by the thickness of the gelatine. Where it is thinnest (corresponding to the darkest parts of the design) etching begins quickly, but over the thicker areas (lighter parts of the design) etching is delayed. Clearly then, parts of the copper will be subjected to the action of the etching solution longer than others. In this way tone gradations are produced.

The etcher is able by virtue of his great experience and skill, so to match the concentration of the etching solutions to the various types of designs, that he can 'bring out' certain tones and suppress others. The total time of an etch can vary from a few minutes to more than an hour, according to design and the ruling of the screen dots used—the coarser the screen the longer the time of etch. The maximum depth of etch of an 80 dot screen is approximately 0.004in., whilst that of a 200 dot is only 0.0007in., the width of line ruling to dot size also having a bearing on the depth of etch.

When a cylinder has had considerable use, slight wear takes place, resulting in a weakening of the printed effect, which can usually be remedied by re-etching. This is achieved by inking up the cylinder with an acid proof resist, and revolving it in ferric chloride solution to rejuvenate the cell depth.



Retouching a photographic positive

Continuous Engraving Process

Certain designs selected for printing lend themselves to the continuous engraving process rather than photogravure. This entails the hand engraving of a small cylinder of mild steel called a die direct from the original art work.

This engraving is carried out by cutting or punching the pattern into the steel die, which is then case hardened in an electric furnace. The next stage is to obtain the reverse of this die on the surface of another small cylinder of mild steel called a mill. This 'raising' of the mill is achieved by forcing the patterned die on to the mill by means of specialized equipment. The mill when complete is then case hardened.

This operation of 'raising' a mill is necessary to obtain the pattern in relief on its surface preparatory to impressing it 'below' the surface of the printing cylinder to provide cells to carry the printing ink.

The circumference of the raised and case hardened mill must be exactly divisible into the circumference of the cylinder, otherwise the pattern would overlap and be ill defined.

The mill carrying the raised pattern is now supported in the mill frame steps of an engraving machine, and brought to bear on the surface of the copper cylinder. By revolving the cylinder and exerting pressure on the mill the pattern is slowly impressed into the copper surface. An index wheel carried on the end of the cylinder is used to set out the repeat size in segments related to the total circumference of the mill. The mill frame is controlled by a worm screw by which it can be precisely positioned along the length of the cylinder.

When the mill has traversed the full length of the cylinder the pattern has been translated from the original drawing into a printing cylinder and now requires polishing to remove copper burr raised during the milling operation. A final polishing operation is necessary to produce a mirror finish for chromium plating.

A copper cylinder when etched or engraved is very prone to damage of the thousands of tiny cells in its comparatively soft surface. Electroplating with chromium is therefore practised in order to provide a hard protective shield against the abrasive action of

the doctor blade and printing ink on the presses.

Another important function of the engraver is the repair of accidental damage to cylinders.

Here he is called upon to remove the chromium plating, make good any damage to the copper, re-engrave by hand and repolish, so that all

Inspecting an etched cylinder

traces of the original damage has been removed and the pattern restored.

Mills are preserved and may be used either to produce replacement cylinders when this becomes necessary due to wear, or irreparable damage, or to remill partly worn cylinders and so prolong their useful life.

The Manufacture of Printing Inks

Some fifteen years ago the printing ink chemist was asked to develop an entirely new ink for use on a hitherto unknown surface—that of calendered PVC. All known printing inks were tested and discarded as unsuitable until it was found that certain copolymers of polyvinyl chloride and polyvinyl acetate, when dissolved in a mixture of acetone and butyl acetate and suitable pigmented, showed a fair degree of adhesion to the PVC films. These inks possessed physical properties which were approximately those required of gravure printing inks.

Solution of these copolymer resins was usually effected in a paddle mixer and coloured by the addition of a pigment/plasticizer paste separately prepared on standard granite mill equipment. These inks, whilst encouraging, were only satisfactory to a degree, the surface of the film to be printed was not always perfect and the printing equipment was usually leathercloth or oilcloth machines which had been modified in an attempt to handle this new material. Printing speeds were slow and the performance of the ink film was sometimes unpredictable.

The reception by the public of these early printed 'plastics' was mixed, although many could appreciate the attraction of a curtain material which could be washed by wiping, or a table square which was not ruined when stained. In the early stages, it was apparent that the light stability of the pigments was inadequate and the ink film of insufficient strength. Clearly then, a new high standard of quality and performance had to be reached, and these properties combined with new and appealing designs were essential if printed PVC was to succeed.

Engraving the die

By 1951 a committee of technical experts drawn from most firms manufacturing PVC film, had together drawn up British Standard Specification 1763 which laid down minimum standards required of both thin printed film and similarly decorated heavy gauge sheeting. This new set of standards stimulated the existing research and development staffs engaged with ink problems, in consequence of which the present day ink has developed.

These new inks are often prepared from low molecular weight PVC polymers, together with new and improved PVC/PVA copolymers and methyl methacrylate. These are frequently only soluble in particular molecular ratios of ketonic and hydrocarbon solvents, a solvent mixture which must at the same time be so balanced that evaporation rates are of the correct order for present day high speed multi-colour work. New pigments were examined for properties which would satisfy both the ink maker and the high standards of performance required. The ideal pigment for a PVC ink must be easily dispersible, be free from all abrasive matter and chemical contamination, be non-bleeding in organic solvents and plasticizers, water and detergent solutions, have high tinctorial strength with a minimum light fastness in all reductions of five on the blue scale of the Society of Dyers and Colourists, and finally it must have a true tone reduction when either blended with white or printed from half-tone tints.

The early inks which contained monomeric plasticizers added in the colour paste were too soft, therefore other methods of dispersion were sought. Pebble mills are now used to manufacture present-day ink, and by this method all the ingredients are brought together in a mill which is then revolved for some hours until the pigment is completely dispersed in the resin solution.

Here, quality control of the finished ink is of equal importance to the control of incoming raw materials. Inks are now tested for fineness of

dispersion on a fineness of grind gauge — no scratch being permitted, and for colour quality by printing from a standard seven tone step wedge gravure cylinder on a laboratory machine.

One of the latest developments is that of a black ink which is non-firing and not tracking when the printed material is subjected to high frequency welding. This has overcome a deficiency which has perhaps delayed the universal adoption of the welding process for the fabrication of PVC articles carrying a black print.

An adequate range of primary colours usually numbers about twelve. These are then used to produce standard shades in bulk from formulae evolved in the laboratory so that a tight control may be kept on all standard shades stocked to service current pattern ranges. By the method of bulk stocking of all shades used it becomes possible to reduce colour drift to a minimum, even though individual designs are printed at intervals of some weeks or months. Here again control of shade is maintained by printing all blends of colour from a step wedge gravure cylinder and comparing the impression so obtained with the registered and accepted standard.

Metallic prints vary in popularity but have not been neglected, bronzes and aluminium powders being used to produce these effects. Some precautions must be taken here, however, as these powders usually lose brilliance when milled. In addition, the medium used with bronze powders, must be stabilized in order to delay chemical tarnishing of the bronze and gelling of the binder solution.

Printing Techniques

The printing of PVC films and sheeting presented particular problems of its own, for machinery which existed when this new material came along had been designed for inextensible webs of artificial leathercloths and oil baizes. These machines had grown with the years alongside and in step with the perhaps more leisurely development of these products between the wars, but, although a printed PVC could be produced on these presses, they were really quite inadequate for the task they were being asked to do.

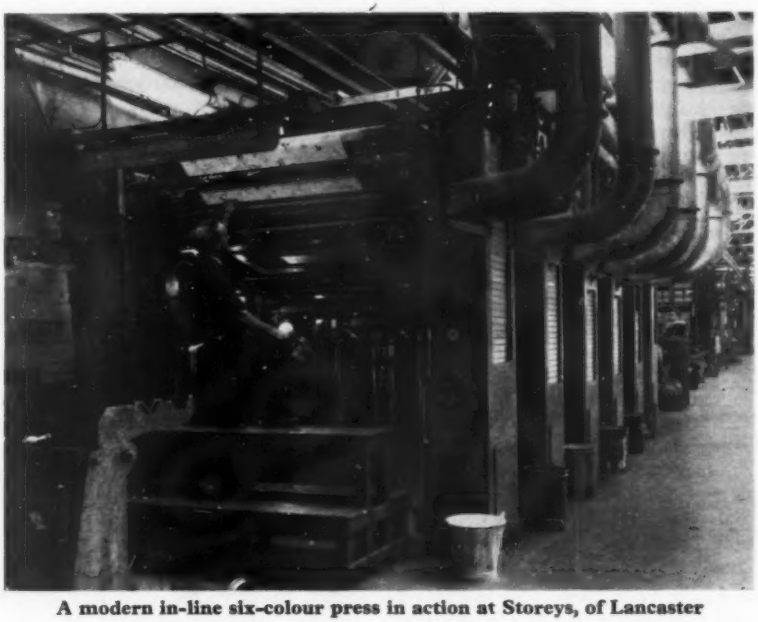
Here was a new material which was extensible under tension yet possessed an elastic memory and would, when tension was relaxed, recover to some degree. It contained certain 'built-in' strains which could be released under the influence of heat, causing distortion. The film surface was largely unattacked by solvents, and was almost non-absorbent, yet such absorbent properties it did possess were to prove a hindrance rather than a help in printing. For these reasons handling was difficult on the machines, and the film could become heavily charged with static electricity, thus increasing the fire risk already present where volatile and inflammable solvents were used.

Existing plant was altered as experience dictated, unwind and rewind equipment was rebuilt and internip drying systems invented and modified as inks were improved and designed to be used at higher machine speeds.

The major problem, at one time seemingly insoluble, was to produce and print an ink in multi-colour work which would remain wet in the cells of the printing cylinder during the time taken to travel between the doctor blade and impression nip, yet, in the space of only twice that time would be sufficiently dry to remain adherent to the PVC surface rather than transfer to the unetched portion of the following printing roller in the design.

After the ink chemist had so balanced the solvent mixture as to make this possible under certain conditions of heat and airflow the printing machine engineer was consulted. He was asked to devise internip drying equipment which would warm the ink film without softening the PVC web and remove solvent vapours so released without accelerating drying on adjacent printing rollers.

The problem of multi-colour printing was attacked from other angles in support of the ink chemist. Experiments were carried out using cylinders made with a variety of screens from 80 lines upwards. The coarser one proved in practice to be superior from the point of view of wear, and when used with the inverted half-tone process in conjunction with the improved inks and drying system, the problem of ink drying in the cells was overcome.



A modern in-line six-colour press in action at Storeys, of Lancaster

Closer viscosity control of the ink was found essential to produce a clean, sharp print, and this quality was ensured by the use of very fine doctor blades.

New machines now incorporate positive screw doctors and when used with the correct thickness of blade, the ink film thickness can be varied within reasonable limits as required. Inverted half-tone used in conjunction with colour separation in up to six colours can now be printed, to give effects comparable with conventional gravure printing on paper. Here again the use of thin doctor blades and close control of ink viscosity is essential if colour and quality are to be maintained throughout the run.

Running speeds are now only just below that which calls for stroboscopic viewing and photo-electric cell register control. Inevitably in the not too distant future these aids will prove necessary.

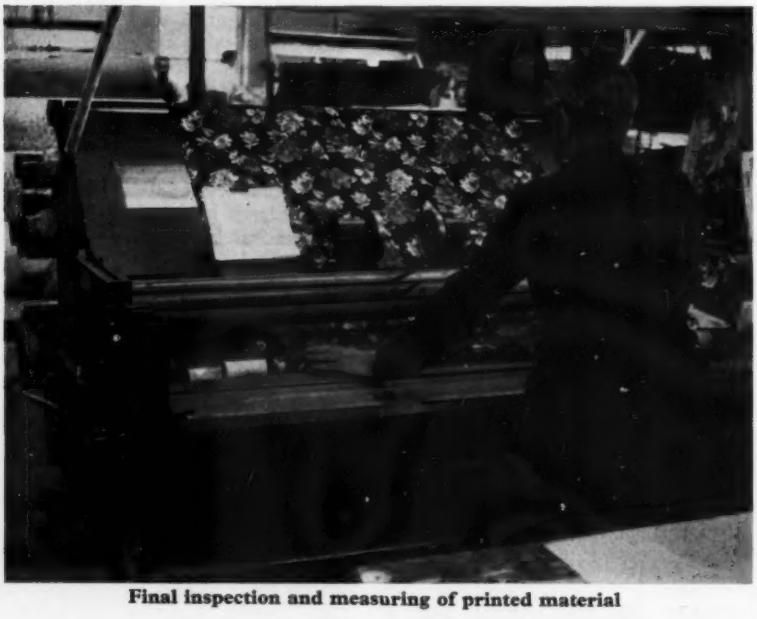
Modern machines incorporate a

rubber or fabric continuous blanket which supports the film both before and after printing, thus permitting much closer fitting patterns to be printed without distortion. Table cover repeats up to 72in. in length can now be printed with precise register control by the employment of variable speed gear boxes at different points on the press. Very fine limits of extension and transverse dimensional contraction are demanded when the sheeting is for eventual lamination. This method of gear box control has proved most successful when used with automatic web guiding equipment.

At one time special requirement for printed film and sheeting in various widths of the same design caused production problems in the way of colour flashes and loss of register. This was due to the swelling of the rubber backing cylinders caused by absorption of the aromatic hydrocarbon content of the ink solvent. Slightly underwidth rubber cylinders of varying Shore hardness were found to overcome this problem and improved production planning reduced the number of cylinder changes for different widths.

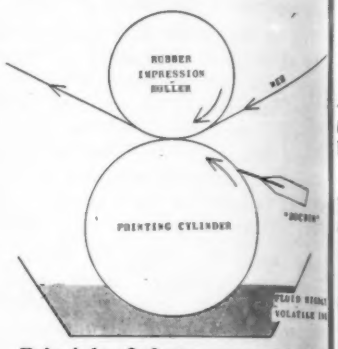
In the early days, designs containing continuous bands, large symmetrical solid areas and texture effects were found to be very troublesome to produce, but special techniques have now been evolved to overcome these problems. Continuous bands tended to cause uneven doctor wear, resulting in cylinder scratches and doctor lines. There is, however, a big demand for these types of designs and engraved rollers have been found to give the longest life compatible with print quality. Texture effects are produced by conventional gravure coupled with hand engraving. On this type of work viscosity control of the highest order is necessary. Large, solid areas unsuited to engraving are now produced by the gravure process using coarse screens. This method prolongs roller life considerably, but unless the printing operation is tightly controlled 'pick-off,' 'plucking' and 'offsetting' problems arise due to the thicker ink film being deposited.

An inherent problem of all printing departments is that of roller storage. It is necessary for Storey's to hold a large stock of printing cylinders to accommodate the wide range of current designs and maintain well over a thousand available for instant use. Cylinders have to be kept in perfect printing condition at all times, and a simple method of cylinder reports was established in the early stages of PVC printing. After each production run patterns are inspected to detect whether preventative maintenance is required in order to keep the cylinders to the original standard. Reports are completed showing whether any maintenance is required and the cylinders are then protected by specially-coated felt wrappers before being transported to the processing department or back to the cylinder stores, where they are held in easily accessible racks.



Final inspection and measuring of printed material

In conclusion, it can be seen th tremendous strides have been mad in the last ten to twelve years i cylinder processing, ink making an printing techniques for PVC. How-



Principle of photogravure printing

ever, there can be no doubt th since the outlets for this very ver satile material continue to grow dail the demands upon the specialist skill of all those associated with this sec tion of the industry will continue t increase.

I.C.I. AT DUSSELDORF

The I.C.I. stand at the Düsseldorf International Plastics Exhibition designed by the Spanish designer Mario Armengol, shows some of the major achievements of the company in the field of plastics. In particular the stand tells the story of the vita part played by research in the dis covery, development and application of major thermoplastic materials.

The discovery of polythene is em phasized and its uses outlined, par ticularly in submarine cables such a the present trans-Atlantic telephon cable 4,500 miles long in which Alkathene, the trade name for I.C.I. polythene, was used. There is also the story of Perspex acrylic sheet, now available in 57 colours, and an example of one of its many uses. This is a bath made from Perspex by the Australian firm of N. V. Appleton which has been in constant use in an Australian house for seven years. Diakon telephones and PVC/Terylene conveyor belting represent others of I.C.I. Plastics Division's output of plastics materials.

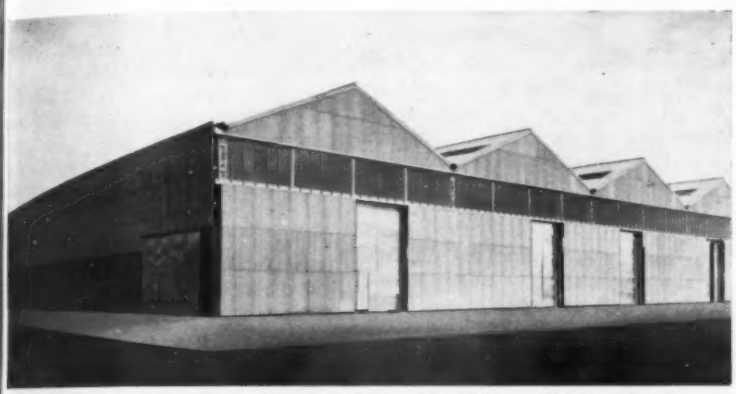
US Rubber Company Sales

Sales of the US Rubber Company in 1959 are expected to be about $950m and earnings could be as high as $5.50 per share, according to the company's chairman, H. E. Humphreys, Jnr. In 1958, the company reported sales of $870,615,700 and earnings of $3.05 per share.

New Glass Fibre Plant

FIRST STAGE OF EXTENSION PROGRAMME

A MAJOR capital expenditure programme that will expand considerably its glass fibre output has been embarked upon by Glass Yarns and Deeside Fabrics Ltd., an associate company of Microcell Ltd.



A section of the new Glass Yarns and Deeside Fabrics Limited factory at Camberley. Its completion with the installation of equipment will mark the first £750,000-stage of the Company's expansion programme

Fibre drawing will begin in two to three months' time from a battery of furnaces now being installed in a large new factory that has just been built at Camberley, Surrey. The completion of this plant will mark the first £750,000 stage of the expansion programme.

The plant, which will eventually be extended over an area of 250,000 sq. ft., will initially produce glass fibre, rovings and mat of the latest types which have been so well received by the market. The plant, which will meet all present requirements will have the capacity to cater for any sudden large increase in demand. It will also handle production of new types of fibre as well as continuing the research programmes which have led to the introduction of products such as 106 type mat.

The latest techniques in automated flow-line production are embodied and the new plant will be capable of producing several types of glass fibre simultaneously. Employment will eventually be given to many hundreds of skilled operatives.

Mr Henry Kremer, chairman of the Microcell Group, states, 'I am confident that the very considerable financial expenditure and technical effort which are going into this new plant will enable us to more than satisfy the enormous increase in demand there has been for our glass fibre raw materials. Our new laboratory facilities will furthermore enable us to improve upon the lead we have already established in quality and technology, and I foresee radical advances of great importance to the glass fibre industry in the next few years.'

Chas. H. Windschuegl Ltd. (1 Leadenhall Street, E.C.3), a member of the Amber Group of Companies have (as from September 30) left their City address and established offices at the Group Headquarters (11a Albemarle Street, London, W.1, telephone: MAYfair 6161), where they will be able to make use of all facilities available to members of the Amber Group.

IISO ANNUAL CONFERENCE

The annual conference of the Institution of Industrial Safety Officers will be held this year at the Grand Hotel, Brighton. The conference will open on November 6 1959 with a dinner attended by delegates to the conference and the guests of the Institution, who will include Mr T. W. McCullough, H.M. Chief Inspector of Factories, Mr R. A. Banks, director of Imperial Chemical Industries Ltd. and Mon F. Mercx, president of the Fédération Européen des Associations Industriels Chefs de Securité.

The sessions on November 7 will include one in which new industrial safety films will be shown and discussed. A paper on 'Training Equipment and Visual Aids' will be presented jointly by Mr B. A. Inshaw, head of the Industrial Safety Division of the Royal Society for the Prevention of Accidents, and Mr B. L. Cornford, Division Safety Officer, Plastics Division, Imperial Chemical Industries Ltd.

Tyres and Speed

The official statement on 'Car Tyres for Fast Motoring' issued by the Tyre Manufacturers' Conference last May, has aroused great interest. Already well over 110,000 copies have been issued to tyre distributors and garages, and through them to motorists all over the country. The statement (reported in *RJIP* May 30) gives advice on what tyres to use when driving at the sustained high speeds possible on Continental highways and on the new British motorways. A large tourist agency is issuing copies to all motorists who book Channel passages and Continental accommodation through their offices.

Polythene caravan covers, made by the firm who developed plastics hay and straw stack covers, Stack Protection Ltd., are in increasing demand. Tests under winter conditions have shown that caravans are kept clean and dry inside and out with no condensation or mildew. The 'Vandrix' cover illustrated is made from single Visqueen polythene sheeting, manufactured by British Visqueen Ltd., Stevenage, an I.C.I. subsidiary. The securing net is supplied free

Latex Coated Paper

IMPORTANT CONTRIBUTION TO QUALITY

Since the change in format at the beginning of 1958, 'Rubber Journal and International Plastics' has been printed on paper coated with Butakon synthetic rubber latex (butadiene copolymer) manufactured by Imperial Chemical Industries Ltd.

IT cannot be claimed that the use of latex in conjunction with paper is entirely new. Many of our older readers will remember Keye's latex paper, and that well known work 'Rubber, physical and chemical properties' published by the Research Association of British Rubber Manufacturers in 1935, has on its title page the statement 'This book is printed on latex paper.'

The present use of latex, however, shows two important differences from the work which was done some 25 or more years ago. First, it will be obvious that at that time only natural rubber latex was available to industry whereas now it is synthetic latex which is giving such favourable effects. A second point of difference is that in most of the earlier work latex was added to the fibres at some suitable stage of paper manufacture, for example, in the beater, whereas now the latex is concentrated in the so-called clay coating which is applied to many papers used for high quality printing. In fact, it may be noted in passing that even 35 years ago paper was coated with latex on a commercial scale. The latex coating was used as a base for subsequent covering with a varnish, with the object of producing 'enrober' paper, that is, the paper on to which chocolates are dropped whilst still in a molten condition. The quantities made were, however, small and were always attended with the difficulties associated with the working of natural latex, in particular, an inconvenient tendency to coagulate with the possibility of spoiling the expensive felts used on the machines.

The revival in the use of latex came in this country in 1956 when the Plastics Division of Imperial Chemical Industries Ltd., started production of synthetic latices based on copolymers of butadiene and methyl methacrylate, polymers of the latter having for many years been made by I.C.I. Ltd. As usual, the new latices were of several types but the one now used as a binder in coated papers is Butakon ML 501, the general properties of which may be summarized as follows:

Butadiene/methyl methacrylate ratio	40 : 60 (approx.)
Solid content ..	46%
Average particle size	0.2 micron
pH	6—7
Viscosity	10 cps.
Stability	Very good stability to added electrolytes and under mechanical shear

Drums of latex in vicinity of coating/mixing plant. (*This photograph and those on succeeding pages of this article were taken by courtesy of Wolvercote Paper Mill*)

The low viscosity of Butakon ML 501 and its relatively high solid content will be noted.

It is necessary at this stage to explain that the so-called clay coating of paper to make it suitable, for example, for the printing of labels, results in improved wet rub resistance, varnish gloss, ink receptivity and pick strength — the last being the resistance of the coating to the tendency for it to be pulled away from the paper during printing. All these are of particular interest in the printing industry but do not merit detailed description here.

In fact, the coating seldom consisted of clay only but a mixture of clay with other pigments, *e.g.* satin white, a pigment specific to the paper coating industry and made by the interaction of milk of lime with aluminium sulphate. Satin white is used only in the form of a water paste; it has the property of increasing the gloss when the coated paper is calendered.

There is no doubt about the excellent results obtainable by the use of Butakon Latex ML 501 but the advantages must be considered against the cost. The following are approximately the relative prices of the latex, of casein in the solid form and of a specially treated starch which is sometimes used as an alternative to casein.

Butakon ML 501 ..	37d./lb. dry solids
Casein	20d./lb. dry solids (average prevailing price)
Starch	8d./lb. (approx.)

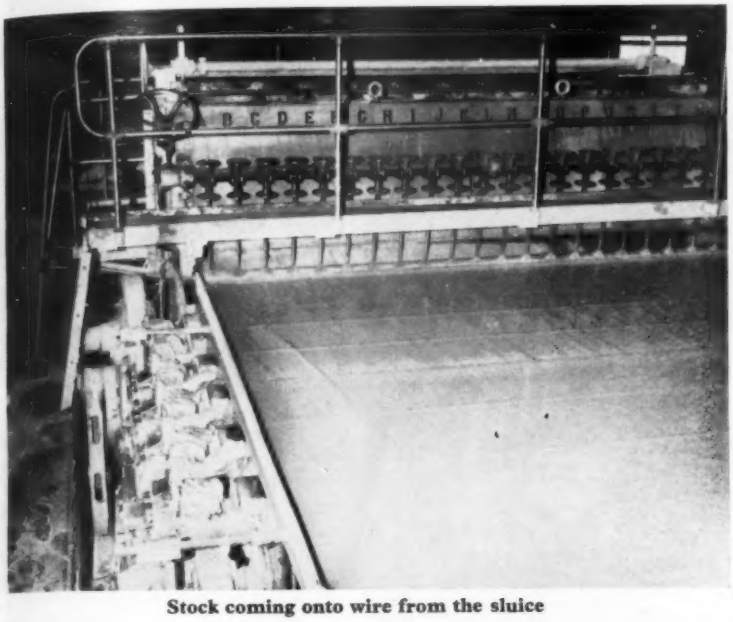
It should be noted that in quoting 20d./lb. for the price of casein, account has been taken of the fact that casein as supplied normally has a moisture content of about 10%.

Some of the price difference between Butakon ML 501 and casein on the one hand and Butakon ML 501 and starch on the other, can be offset by the fact that the latex is a better binder. However, that direct replacement of casein or starch increases the cost of a coating mix is inevitable. Needless to say, other factors must be taken into account when assessing the effect of using Butakon ML 501 on the cost of the finished paper. For example, the extra cost of the coating mix can be absorbed if a greater weight of coat-

ing can be applied than was hitherto possible, since coating is cheaper than paper fibre.

When Butakon ML 501 is used not simply as a direct replacement for casein but in a completely re-

price equivalent to £30 per ton dry solids has been used, and this is thought to be a fair average, but some mills may find that their production cost is a little less. The advantages in ease of operation of the



Stock coming onto wire from the sluice

formulated mix, the higher cost of latex can become of less importance. Take, for example, the clay/calcium carbonate coating recommended as an alternative to clay/satin white. The following cost data are worthy of consideration.

			Parts dry wt.
Coating Mix I			
Clay	@	1.61d./lb.	70
Satin white	@	3.36d./lb.	30
Casein	@	20.0d./lb.	22
Cost per dry lb. of coating = 5.36d.			
Coating Mix II			
Clay	@	1.61d./lb.	70
Calcium carbonate	@	4.18d./lb.	30
Casein	@	20.0d./lb.	11
Butakon ML 501	@	37.0d./lb.	4
Cost per dry lb. of coating = 5.26d.			
Coating Mix III			
Clay	@	1.61d./lb.	70
Calcium carbonate	@	4.18d./lb.	30
Casein	@	20.0d./lb.	8
Butakon ML 501	@	37.0d./lb.	6
Cost per dry lb. of coating = 5.44d.			

From these figures it will be seen that a large proportion of Butakon ML 501 can be used in a clay/calcium carbonate mix without making the cost of the coating very different from that of the conventional satin white mix. This is because of the much lower total binder contents required when satin white is replaced by calcium carbonate. It is true that the price taken for satin white affects this argument somewhat. Here a clay/calcium carbonate mix should, however, fully justify a slightly higher cost of the dry coating.

To sum up: it is now a generally accepted fact that synthetic latices are making an important contribution to improvements in quality in all the world's leading coated paper and board producing countries. That the merits of using latex justify the slightly higher raw material cost that may be involved is proved by the fact that so many of the world's coated papers and boards now contain latex binder.

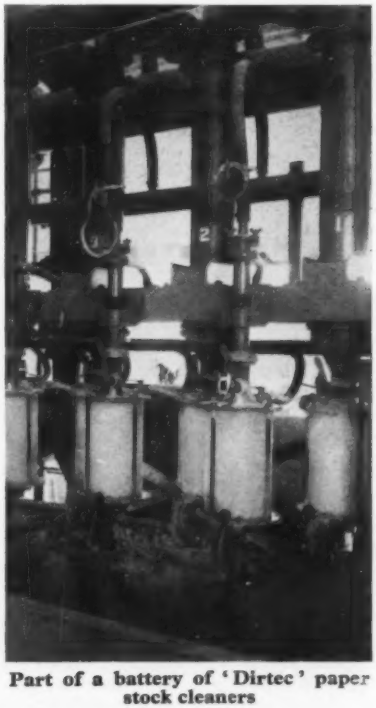
Coating the Paper

The actual application of the coating to the paper may be made by one of several methods. So-called size press is not a press at all in the generally understood term, but refers to spray application followed by squeeze rolls. Massey coating uses five or six very large rubber-covered rolls which oscillate from end to end in a similar manner to printing rollers. The first of the series runs in a tank of coating mix and the last roller applies the coating to the paper. The so-called Champion coating devised by the Champion Paper and Fibre Co. of Ohio applies the coating to the sheet of paper which is about half dry, that is, the coating section is to be found about half way along the drying cylinders of the paper machine (illustrated). A roll rotates in the trough of coating mixture (containing latex) and is rotated against the direction of movement of the paper. The coating is thus applied to the underside of the paper which then passes over a small rotating doctor blade fitted in a groove on the edge of the tank. In this way, one side of the paper is coated. If the second side is also to be coated, the coating is done as a later operation when the direction of travel of the paper has been reversed.

RJIP on Coated Paper

One of the many mills now using Butakon Latex ML501 in Champion machine coating is the Wolvercote Paper Mill near Oxford. The coated paper from this mill has been used in the printing of RUBBER JOURNAL AND INTERNATIONAL PLASTICS since the issue of January 4 1958 when, as readers will recall, the make-up of the Journal took its present form.

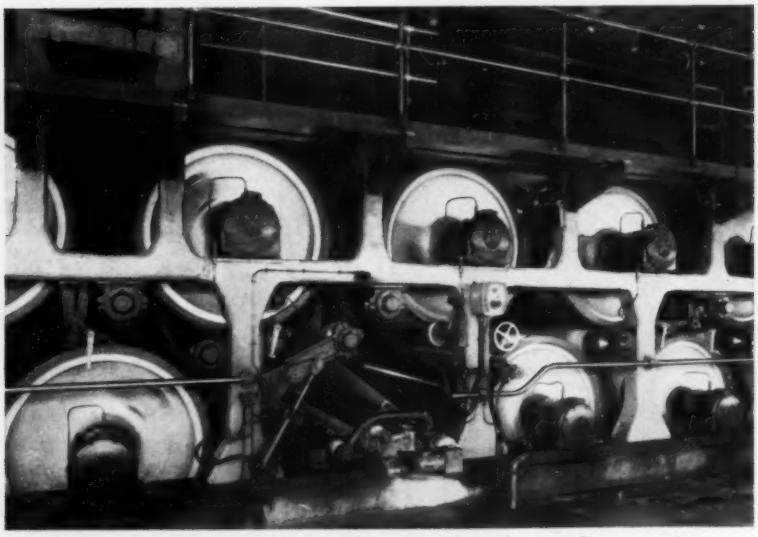
There has been a paper mill at Wolvercote on the same site since 1670. About 1870 the mill was acquired by one of the partners of the Oxford University Press to whom ownership was later transferred. The mill now makes high grade printing papers not only for the Oxford University Press but for many other users. A new paper machine (manufactured by the firm of Millspaugh of Sheffield) was installed about two years ago and at the same time the



Part of a battery of 'Dirtec' paper stock cleaners

offices and other parts of the mill were modernized.

Details as to the method of working have been kindly supplied by the technical manager of the Wolvercote Mill, Mr Sinclair. The coating process which is operated on the actual paper-making machine is much more rapid and also much cheaper than in the so-called 'off' machine processes where finished paper is, so to speak, reprocessed.



Part of a drier section showing 'Champion' coating unit by-passed

At Wolvercote the coating is applied at the rate of about 500ft. per minute on a width of 150in. The coating mixture is prepared in two parts, each part being first mixed in a stainless steel tank. China clay only is used (SPS quality) of English China Clays and this is mixed with water, using Calgon (supplied by Albright and Wilson Ltd.) as a dispersing agent. In a second stainless steel tank the casein is dissolved by means of ammonia, the mixture being heated by open steam. A small amount of Panacide (British Drug Houses Ltd.) is used to prevent bacterial decomposition which is liable to be troublesome with casein solutions, particularly in warm weather. The casein solution is mixed with the clay dispersion and the latex added.

Sieved and Stored

The complete mix is then sieved through special machines (supplied by Russell Constructions Ltd.) into two 600-gallon stainless steel tanks (L. A. Mitchell), where it is stored ready for feeding to the two coating stations.

At present, the latex is supplied in drums, but it is expected that this will later be replaced by bulk deliveries. Approximately 10 parts of latex are used for every 100 parts of clay. The consumption of coating mixture averages about 1781b. per hour. The mill runs without stopping 24 hours per day seven days a week but the coating section operates only about 10 days per month.

Turning now to the manufacture of the paper itself, the raw material is wood pulp. Every precaution is taken to keep this clean and to maintain clean conditions throughout the whole of the manufacture. The water used is drawn from the adjoining river Thames (known locally as the Isis) and great care must be taken with the effluent to avoid pollution of the river, in particular, harm to the fish which may be seen in large numbers at the ancient Trout Inn quite near to the paper mill.

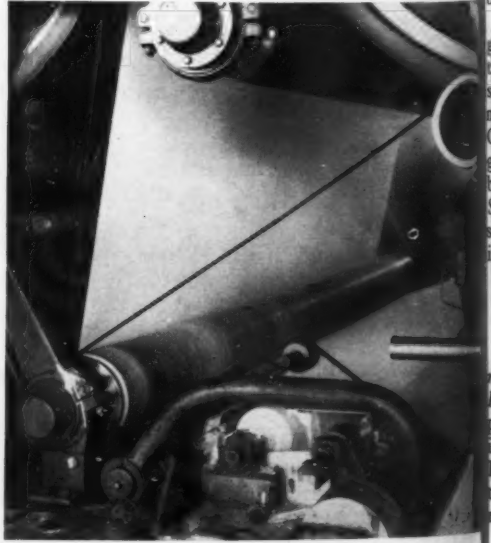
The bales of wood pulp are mechanically tipped into one of the two hydra pulp machines which break down one ton of pulp in about twenty minutes. From the pulpers the mixture passes to storage chests—large tanks lined with tiles and fitted with agitators. Thence, the mixture of fibres and water goes through a series of refiners (Massor, Scott and Co. Ltd.) which, in a modern mill such as Wolvercote, replace the old paper beaters. A special device keeps the consistency of the slurry constant. There is a series of settling vessels in which the flow of the slurry is momentarily arrested, thus allowing any dirt which is present to fall out and be removed.

Dilute Mixture

The mixture of fibres and water is next fed evenly to a moving wire band which moves forward and at the same time reciprocates. The mixture is extremely dilute, having a solids content of 0.8% only. As it is fed it is sprayed with water from above to break up any froth.

Water is removed from the thin layer on top of the woven wire, first by means of a vacuum and then by pressing with two large endless felts. These felts are kept constantly clean by means of a special washing device below which slowly traverses the felt so that every section is washed. When most of the water has been removed, the web is dried by passing over a series of 31 drying cylinders.

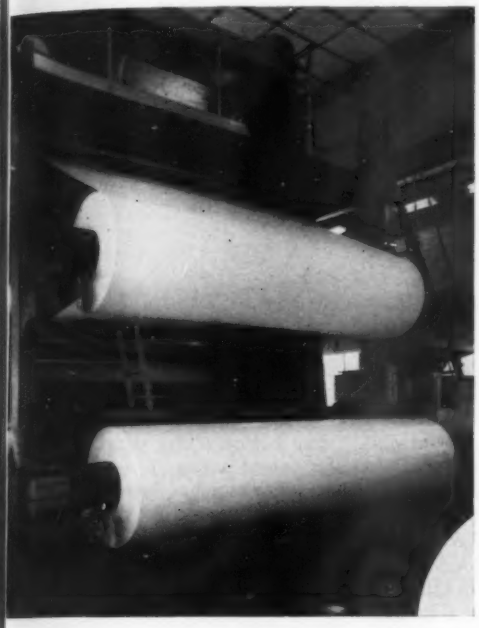
Some kinds of paper are not coated in which case they pass straight through the calender which follows



Sheet passing over first wire side-coater (seen from front side of machine)

the drying cylinders, or through the super calender if a specially high glass is required. When coating is to be done, it is carried out at a point about midway between the beginning and end of the drying cylinders section as previously explained. The finished paper is slit to the required width and when necessary, cut into sheets.

About six different types of paper are made at Wolvercote. Much of the uncoated paper is used for the printing of Bibles in all languages for which the Oxford University Press is famous, but coated papers are finding increasing use for many other types of publication, and also in labels for foodstuff packages. Readers will see for themselves the excellent results which Wolvercote's coated paper is giving in this Journal.



Paper being super-calendered

Cold Curing Silicone Rubbers

Midland Silicones Ltd. have promoted their cold curing silicone rubbers from an experimental to a bulk production basis.

The rubbers are made in three grades: Cold-Cure Silastomer 9159, the heavy grade which has the consistency of builder's putty and can be moulded, milled or calendered; Cold-Cure Silastomer 9160, the medium grade which can be spread or applied by caulking gun; and Cold-Cure Silastomer 9161, the liquid form suitable for dipping, injection or impregnating.

Rubber Costing

The second edition of *The Technique and Practice of Costing for the Rubber Manufacturing Industry* was published on October 15. The book is published by the Federation of British Rubber and Allied Manufacturers at 15s. post free. We shall review it in our issue of October 24.

BRAKE LINING USES RUBBER

'Nu-Texa' FM1. is a flexible moulded brake lining, consisting of a recently-developed synthetic copolymer based on the acrylonitrile butadiene system, and heavily loaded with short and long fibre asbestos, together with other friction modifying elements. Being flexible it can conform to the irregularities of the shoe to which it is fastened, being either riveted or bonded. Being much more resiliant than the more orthodox type of brake lining, it is able to absorb vibrational energy and consequently has very good anti-squeal properties.

The material is compounded for high temperature resistance and will work satisfactorily in contact with brake drums, whose temperature exceeds 300°C. This quality of brake lining can be produced in individual liners or in rolls up to 25ft. in length.

Dymer of Canada

The Canadian concern, Dymer Plastics Ltd., has announced the commencement of work on a new plastic insulation plant at Edmonton, Alberta. Investment is estimated at $400,000. The plant will manufacture plastic foam insulation board to be used primarily in the petroleum and chemical industries, especially tanks, pipeline wrapping, and in cold storage plants, dairies, roofing and insulation plaster base.

The whole of the front wings of this Dennis 'Pax' six-tonner are made from reinforced Bakelite polyester resin, and the radiator surround, valance and lamp housings are made from the same material

PVC/Steel Laminates

WIDE SCALE USES AND TREMENDOUS POTENTIAL

By W. E. MARTIN

IN the 10 years or so since the Hood Rubber Co. in the United States first made vinyl/steel laminates for I.B.M., plants for sticking a PVC covering on to metal sheet have been erected in most major countries. The first really acceptable process was developed by the U.S. Rubber Co., making the laminate by a semi-continuous method instead of the more laborious press one originally developed by Hood. Alongside this development a number of concerns were working on organosol coatings but progress has been comparatively slow.

The first major steel sheet company to take up the Marvibond process was Belgian firm of Phenix Works and they have been making a sheet laminate on to both steel and aluminium since 1956. The English company, John Summers and Sons Ltd., had been considering plastic coatings for some time and in conjunction with BX Plastics Limited commenced work on a continuous coil plant in 1955. This plant, brought into operation in September 1957, was the first major continuous coil line. Other British companies following the laboratory work performed by BISRA have taken up vinyl coating. We now have several continuous narrow coil plants working and just recently the second of our large steel sheet producers, R.T.B. Ltd., have announced their product. In the US it has recently been announced that U.S. Steel have established a continuous coil line using an organosol coating. Hunter Douglas have been making a vinyl-coated aluminium in narrow coil using organosols for some years, but this manufacture by U.S. Steel is the first large plant to use the paste coating principle.

It will be appreciated that not only is there a considerable production of vinyl/metal laminate but that the product now has quite a long history. This factor is probably mainly responsible for the increased use to which the product is being put.

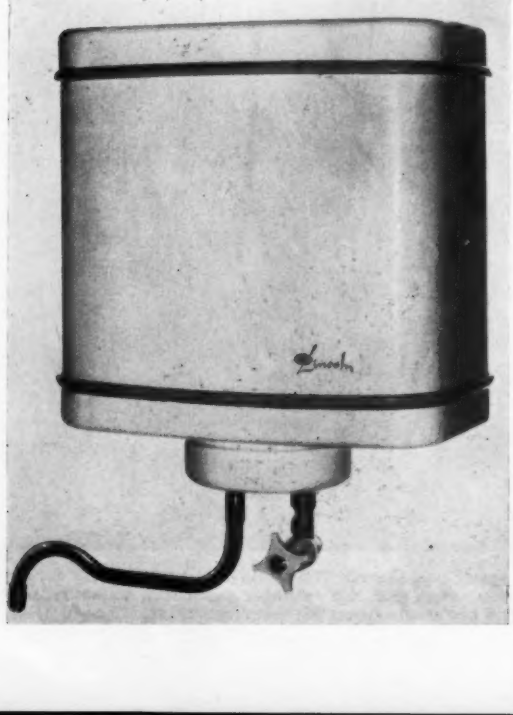
The coating of a flat metal sheet with a thin coating of PVC-based material may be done by three commercially practicable methods, viz., sheet lamination, whereby a continuous film of plastic is made separately and then laminated to the base metal, organosol coating, where the plastic is spread as a paste on to the base and spraying which, in principle, is the spray coating of an organosol. Much theorizing has been done on the comparison of these methods as regards the cost of the finished product and indeed it is of paramount interest to get this cost down to a level where the laminate will compete effectively with a painted product. Until the advent of the U.S. Steel plant, however, no practical data were possible and even now it will be some time before useful data are available for consideration. The writer feels that most advantage lies with the sheet lamination process and it may be interesting to consider just what is useful about a vinyl integument stuck on to a flat steel or aluminium sheet so as to get the picture in slightly clearer focus.

Millions of square feet of steel sheet have to be protected from corrosion each year. This is done mainly by painting and it is a corner of this paint market that vinyl sheet is trying to take. Vinyl film has little to offer over paint from the point of view of range of colour, stability of colour to weathering, resistance to scratching and chemical resistance. It is mostly more expensive than paint and is fairly difficult to 'touch up' when damaged. It has to sell, therefore, on certain unique properties which offer some real advantage over a paint finish.

Probably the most important of these is the embossed or texturized finish which is available to the sheet laminator and the organosol coater. This finish gives a special attraction to wall panelling for interior decoration and is something beyond the present capabilities of the painting method.

Secondly, the printing of vinyl sheet is very well established and the decorative effects far surpass anything possible with paint. It is possible to print direct on to an organosol coated sheet but this would certainly be difficult and would not compete in cost or range with established vinyl sheet printing.

Thirdly, a vinyl-coated sheet may be drawn just as the uncoated metal without disturbing the vinyl layer.



This water storage heater made by the Santon Company from Stelvetite makes full use of the advantages of vinyl coated steel

View of the third floor offices in the new John Lewis building in London. Partitioning on the right is green Stelvetite with a seal embossing. On the left, grey-green Stelvetite is used for the offices, fronted by cherry red dwarf partitioning

This is impossible with paint. The process is particularly useful for the construction of complicated metal structures which would require costly painting apparatus.

There are other unique features of vinyl films which do not yet appear to have been properly exploited. Lightly plasticized PVC has quite a high electrical resistance. 300V. per mil. is quoted in Britain, although the figure 700V. per mil. appears in US literature. In the US this insulation is considered sufficient for protecting the outer case of a television set but British practice is clearly more cautious. Low thermal conductivity is also a feature of the vinyl film and a 10 to 20/1,000in. layer gives a very warm 'feel' to steel sheet. The ease with which PVC can be welded to PVC by a high frequency current is well known and with certain limitations vinyl-coated metal can be welded together by this process. Very effective welds can also be made by simply fusing the two vinyl surfaces together by conducted heat.

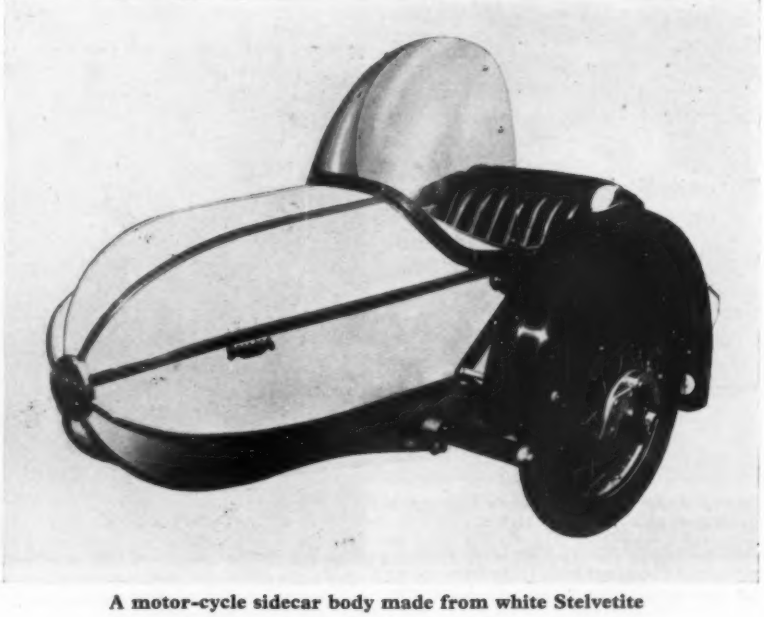
From the foregoing it will be seen that vinyl-coated metal would appear to have definite advantages over paint for certain special applications. If it were possible to bring down the price of these laminates to a level slightly below the cost of normal painting, the market would expand rapidly but even at the present prices a wide and increasing usage is being established. The protagonists of organosol coating maintain that this process is potentially much cheaper than sheet lamination and it may be that we shall soon see a vinyl-coated sheet at a price competitive with paint. The difficulties of maintaining good control of organosols are, however, considerable and metal sheet makers may prefer to shift all the responsibility for the vinyl coating on to the plastics industry. PVC sheet is a well-established product and is very cheap to print. One other factor which may be important is the growing use of thin unplasticized PVC sheet laminated to metal. This type of sheet has very high resistance to chemical attack and is more resistant to staining than the plasticized product. It also has greater resistance to the spread of flame and this may bring it rapidly into the field of public transport and building. It would appear difficult to produce an unplasticized PVC skin by either organosol or spray coating.

Established Uses

Knowledge of the current applications in the US is somewhat hazy but from a study of advertisements and the literature it would seem that laminates go mainly into architectural uses, radio and television, transport and furniture. The pattern has been followed both in Belgium and Britain, except that in some cases the market for the finished product has not been big enough to justify the necessary tooling. In Britain, although Skinplate is available from Belgium, the main development has been done with Stelvetite. This is a steel/vinyl laminate, electro-zinc coated on the reverse side. The vinyl film is 14/1,000in. thick and despite many temptations to lower this thickness, Stelvetite has maintained that the finish must be hard wearing as well as decorative.

Architectural Uses

Steel panelling and partitioning is very acceptable to modern building designs. Vinyl-coated steel is easy to work and can be got through the fabrication shop at a much faster rate than with the painted product. The enclosed finishes give a new and very pleasant look to rooms and offices and can be specially chosen for ease of cleaning. The static charge which



A motor-cycle sidecar body made from white Stelvetite

Inside of an escalator using Skinplate vinyl steel laminate

normally collects on PVC films is earthed by the steel backing and the laminate is thus free of ' static ' dirtying. Most important of all, the fire risk is very low. Since the resistance of plasticized PVC films to scuffing is very high, this panelling should give a long life even under the most arduous conditions. Laminate has been used out of doors for many years in the US and indeed one manufacturer claims that his material is colour fast for a period of five years. This must represent actual field trials and it is very difficult to predict what a further five years will do. Evidence suggests that any colour will change slowly but that mostly it will do so uniformly over the whole of the exposed area.

Domestic Equipment

This industry uses a lot of steel sheet and it is not surprising that vinyl/metal laminate is finding applications where a hard wearing, new type of finish is required. Deep freeze cabinets, spin driers and water heaters are now very active users. In Britain, the Santon Company are making water storage heaters that utilize nearly all the advantages of vinyl-coated steel. The casing of the heater comprises two deep drawn end pieces and a wrap around shell. The product illustrates the potential of laminate fabrication, the deep drawn parts showing just how little distortion of the plastic surface is caused by drawing and the embossing specially chosen for hard wear and ease of cleaning.

Furniture

Under this heading comes tables and chairs, trays, office furniture and desks and shop fittings. In the US great progress has been made in occasional tables and chairs. They have been able to press table tops to shape so that only smooth rounded corners are visible. The tools to do this are quite expensive and no one in Europe has yet attempted to do the job on such a scale. Since there appears to be no other really satisfactory way of making a table top we may have to wait some time before seeing this market develop. Office desks also await a really satisfactory way of fabricating a rounded corner. Vinyl laminate has much to recommend it for this application being much warmer to the touch than the painted product and capable of showing the leather type embossings beloved of many offices.

Radio and Television

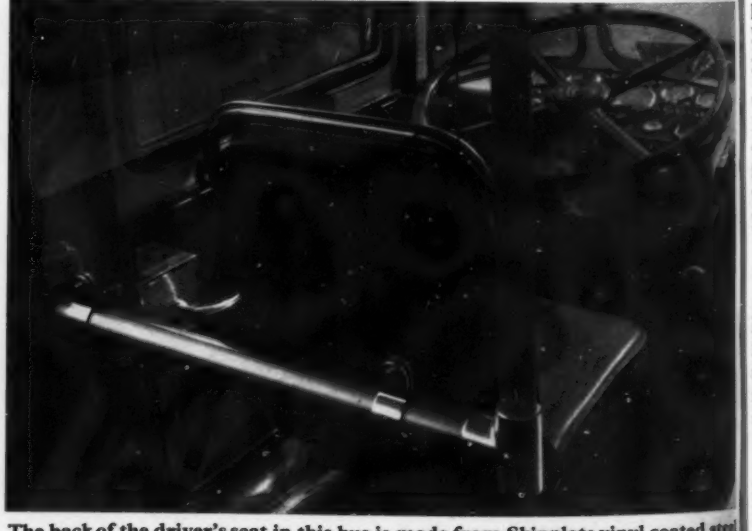
Both in the US and Europe the use of plastic laminate in the construction of radio and television receivers is growing rapidly. Aluminium is preferred both on account of lightness and comparative freedom from corrosion. In Britain, however, apart from some special applications there appears to be little usage. The growing popularity of the battery operated receivers may remove objections to the use of metal in the outer casing.

Luggage

For many years Schwayder Bros. in the US have made ' Samsonite ' luggage using a laminate of PVC and magnesium/aluminium alloy. This has been an outstanding success particularly in air travel where cases are apt to get quite rough treatment. A suitable metal sheet has not been available in Britain, but there are indications that this has been rectified and we may soon see luggage built on this principle.

Drums

This industry, one of the largest consumers of steel sheet has been



The back of the driver's seat in this bus is made from Skinplate vinyl coated steel manufactured by Phenix SA, Belgium

searching for a chemically resistant, non-chippable coating for the interior of drums. Vinyl coatings are ideal for a number of applications and considerable work is going on to achieve an economical method of fabrication. The main problem to be overcome is the provision of a quick and easy method of ensuring a plastic continuum inside the drum. The body is made by making a cylinder of a sheet of laminate and welding the steel edges together. To do this, a strip of PVC about ¾in. wide has to be removed from the weld line since otherwise it would get charred by the heat in the weld. A method has to be found then of replacing the plastic and welding it both to the main PVC face and to the bared steel. The weld to the PVC can be done quickly by an hf method but some reasonable bond to the bared steel part is also needed. There are obviously other ways of making drums and these are being investigated. One particular use in drums is firmly established. This is where a plastic, usually polythene, bag is used inside the steel drum as a liner. A PVC-faced drum lid is used to provide a corrosion resistant 'top' to the drum.

There are many other applications which do not fall conveniently under headings but it can be appreciated that a considerable usage is being found. One recent US estimate of consumption for 1958 was 25 million sq. ft. and this was reckoned to rise to a 100 million within a few years. Variety and improvements in the laminate and techniques of fabrication are inevitable and already we have in production or 'near production' in this country:

1. Coated mild steel in continuous narrow strip or individual sheets from 16 to 26 gauge steel. This is either electro zinc backed or lacquered.
2. Coated tin-plate, the metal 0.010in. to 0.020in.
3. Coated aluminium in individual sheets.
4. Coated magnesium / aluminium alloy.
5. Coated galvanized steel sheet.

In conjunction with this production, special welding techniques have been developed which enable metal to metal welds to be made without disturbing the PVC face, adhesives have been compounded to adhere PVC to PVC without affecting the bond of PVC to metal base, extrusions made to provide a variety of joining methods and coloured pastes developed for gap filling and repairing scratches.

Mr R. G. Cooke has been appointed to the board of Gordon (Malaya) Rubber Estates Ltd. Mr L. I. Simpson has resigned.

Man-Made Fibres

The man-made fibre industry has continued its recovery; since June production has been more than in the corresponding months of 1957, before the setback in output. In August production was 13% more than two years earlier and 60% more than August last year when output was low. The increase in staple fibre output was 72% compared with August 1958; continuous filament yarn was 48% more. Board of Trade figures for August (million lb. 'delivered weight' basis) for continuous filament yarn and staple fibre is 39.7.

Dusseldorf Exhibition

Reviews of the International Plastics Exhibition — 'Kunststoffe 59'—which opened October 17 will appear in later issues of *RJIP*. A number of previews have already appeared in the Journal.

The address of Godfrey L. Cabot, Inc., has been changed to 125 High Street, Boston 10, Massachusetts, and the company's cable address now is—'Cablak' Boston, USA.

Canadian Asbestos

Canadian producers of asbestos shipped 925,123 tons in 1958, down 11.5% from the 1957 total of 1,046,086 tons, according to the annual industry report. Value of shipments declined 11.7% to $92,277,000 (excluding value of containers). Gross selling value of products from 22 establishments in 1958 dropped nearly 12% to $95,281,000 ($108,014,000). Employees decreased to 6,997 (7,357), salaries and wages to $32,025,000 ($32,283,000), cost of fuel and electricity to $5,741,000 ($6,008,000) and cost of process supplies and containers to $12,798,000 ($14,558,000).

Natural Rubber Prospects

In his report to the annual meeting, Mr T. B. Barlow, chairman of the Majedie (Johore) Rubber Estates said the outlook for rubber was encouraging. He said the recent high prices ruling for spot rubber must be detrimental to the long term interest of the industry. It could only stimulate the use and production of synthetic substitutes.

He welcomed the decision to release part of the American and English stockpiles in an orderly manner, and said that the minimum price at which they were liquidated might well prove to be the maximum market price.

'Araldite' epoxy resins and glass cloth are being used by the Royal Aircraft Establishment, Bedford, to make aircraft models required for tests in spinning characteristics in free flight. These models, which are instrumented, are launched from a balloon at a height of 3,000 ft. with controls set to promote a spin. In a recent test, one model imbedded itself 2 ft. into the ground and was recovered undamaged for further use. 'Araldite' resins and glass cloth are manufactured by CIBA (ARL) Ltd., Duxford, Cambridge

Behaviour of Rubber at High Temperatures

By R. C. W. MOAKES

THE search for materials with rubberlike properties at higher temperatures and for longer service lives has gone on continuously since the time that vulcanized natural rubber was first put into the service of men. Some of the earlier uses for temperature resistance were in steam hose and as the binding material in brake linings. More recently the need has been in seals and diaphragms in aero engines whose operating temperatures have steadily been stepped up over the last 20 years. Currently, the aircraft and rocket industry talks of requirements for rubbers to operate at up to 1,000°F. although some of their requirements are for quite short service lives.

Since all organic rubbers with normal compounding and heat vulcanization will give a reasonable service life at temperatures up to 70°C. this can arbitrarily be taken as the lower limit of 'high' temperature[1].

This provides a useful dividing line as for many years 70°C. has been used as the temperature of standard ageing tests for natural rubber. In fact British Standard 903 'Methods of testing vulcanized rubber' part A19:1956 lays down that heat tests in ovens at temperatures above 70°C. should be regarded as tests to simulate service life and not as accelerated ageing tests. On this question of tests to simulate service life, aircraft manufacturers have tended over the last few years to bring out numerous specifications for synthetic rubbers incorporating their own particular test procedures and particularly using their own test temperatures. This has made things very difficult for many rubber manufacturers, and a strong plea is made for more standardization in these matters particularly in test temperatures to simplify in one small way the task set to the rubber manufacturers to meet increasingly difficult conditions.

THE AUTHOR

R. C. W. MOAKES, B.Sc., A.R.I.C., F.I.R.I., was educated at Whitgift Middle School, Croydon, and graduated by part-time study at Battersea Polytechnic whilst serving as a laboratory assistant at the Research Association of British Rubber Manufacturers, whose staff he first joined in 1932. *Now Head of Technology Division of RABRM, he is a member of the Council of the IRI and an examiner in Rubber Technology for the Associateship of the IRI. He is also the Convener of the International Working Group which deals with ageing tests. This Group is one of the series set up by the International Standards Organization Technical Committee* 45-*Rubber to standardize internationally test methods for rubber.*

In particular only the temperatures quoted in BS 903, *i.e.* 100°C., 150°C., 200°C., and 250°C., should be used.

Writing in the RUBBER JOURNAL AND INTERNATIONAL PLASTICS recently[1] 'Crosslink' suggested a series of temperature bands for classifying the suitability of various rubbers for high temperature service, as follows:

Up to 70°C.	Band I
70-100°C.	Band II
100-130°C.	Band III
130-160°C.	Band IV
160-200°C.	Band V
Above 200°C.	Band VI

He comments that by special compounding a given rubber may be stepped up one or even two bands so that in fact it does not really represent the true state of affairs. It is felt that it is better to give a classification based on temperatures above which the rubbers would not normally be considered as the service life would always be totally inadequate, irrespective of compounding method, such as:—

70-130°C.	Natural rubber, SBR, neoprenes, acrylonitriles, polyurethanes.
130-200°C.	Acrylic rubbers, butyl.
Above 200°C.	Silicones, fluorinated rubbers.

The assessment of high temperature resistance by deterioration of tensile stress-strain properties measured at room temperature.

Special Heat Resistant Rubbers

The conventional method of assessing resistance to hot conditions has in the majority of cases been measurement of tensile stress-strain properties at room temperature after one or more periods in air ovens at arbitarily selected temperatures related to the service conditions. Usually the index of deterioration is taken as the percentage reduction in tensile strength. Some results obtained in the RABRM laboratories[2] some years ago illustrate this method of assessment.

The details of the mixes used and the cures Tables 1 and 2) were as follows:

1. *Kel-F elastomer* 100, proprietary silicone-treated fine silica 20, zinc oxide 10, dibasic lead phosphite 10, benzoyl peroxide in silicone oil (1:1) 6. Press cured 30 minutes at 110°C., oven cure 16 hours at 150°C.
2. *Poly FBA* 100, proprietary silicone-treated fine silica 40, zinc oxide 10, dibasic lead phosphite 10, benzoyl peroxide in silicone oil (1:1) 6. Cure 60 minutes at 150°C.
3. *Silicone*, a commercially available ready-compounded stock press cured 5 minutes at 125°C., oven cured 24 hours at 250°C., not compounded especially for resistance to heat.
4. *Acrylon EA-5* 100, stearic acid 1.0, SRF black 50, triethylene tetramine 1.5, sulphur 1.0. Cure 90 minutes at 153°C.
5. *Medium acrylonitrile* 100, SRF black 50, zinc oxide 5, stearic acid 1, T.M.T. 3, poly-trimethyldihydroquinoline 2. Cure 60 minutes at 141°C.
6. *Butyl* 400 100, HMF black 50, SRF black 20, mineral oil 6, zinc oxide 5, MBTS 4, p-quinone dioxime 2, sulphur 2. Cure 90 minutes at 153°C.

A consideration of tensile strength alone (Table 1) suggests that Kel-F Elastomer, Poly FBA, Silicone and the acrylate rubber Acrylon EA-5 will withstand up to three days at any temperature up to 200°C., but if elongation at break is also taken

into account then Poly FBA is excluded as it rapidly becomes inextensible at 150°C. or over. This emphasizes the need to consider both tensile strength and elongation at break in assessments of deterioration due to hot air. Acrylonitrile rubber compounded for heat resistance after an initial fall in tensile seems to maintain a certain level of strength quite well both with increasing temperature and with increasing time at a given temperature but elongation at break does not behave in the same way and suggests that this material is unsuitable for a period longer than about three days at 125°C. Butyl behaves in a manner opposite to acrylonitrile in that it softens rather than stiffens; at temperatures above 125°C. it loses strength very rapidly but its elongation at break is still quite high after three days at 200°C.

Table 1

CHANGE OF TENSILE STRENGTH IN AN AIR OVEN FOR CONDITIONS STATED

Rubber	1 *day at:* °C.					3 *days at:* °C.					14 *days at:* °C.				
	100	125	150	200	250	100	125	150	200	250	100	125	150	200	250
Kel-F elastomer (1)	115	100	64	77	9	98	111	75	70	0	103	115	62	62	0
Poly FBA (2) ..	101	104	98	107	0	101	111	111	126	0	106	120	0	0	0
Silicone (3) ..	87	73	85	95	69	98	91	102	100	60	82	65	105	109	0
Acrylon EA-5 (4)	108	94	120	120	0	100	121	111	95	0	107	103	—	0	0
Medium acrylonitrile (5) ..	97	41	32	30	56	104	47	20	27	16	102	42	24	34	0
Butyl (6) ..	103	93	18	13	0	97	89	6	5	0	94	60	0	0	0

Table 2

CHANGE OF ELONGATION AT BREAK

Rubber	1 *day at:* °C.					3 *days at:* °C.					14 *days at:* °C.				
	100	125	150	200	250	100	125	150	200	250	100	125	150	200	250
Kel-F elastomer (1)	109	97	112	126	0	109	91	126	120	0	109	91	135	150	0
Poly FBA (2) ..	100	67	17	17	0	83	79	0	0	0	83	38	0	0	0
Silicone (3) ..	115	108	92	92	100	92	108	85	92	0	115	69	92	77	0
Acrylon EA-5 (4)	75	69	50	56	0	69	63	38	44	0	75	50	—	0	0
Medium acrylonitrile (5) ..	79	29	0	0	0	72	27	0	0	0	45	2	0	0	0
Butyl (6) ..	92	67	117	125	0	92	67	46	79	0	71	71	0	0	0

All results in these two tables are expressed as a percentage of the results obtained on the same rubbers before any exposure to hot air.

Natural Rubber

In the work just described natural rubber was not included, as until recently it would not have been considered suitable for more than very intermittent service in air at 125°C. Work carried out at BRPRA[3] has shown that vulcanizing with dicumyl peroxide in the presence of zinc dimethyl dithiocarbamate, lime, an antioxidant selected especially for heat resistance, usually polymerized trimethyl-dihydroquinoline and the zinc salt of mercaptobenzimidazole (ZMBI) produces vulcanizates which have very great resistance to deterioration of tensile properties in air at temperatures up to 125°C. It has been shown that synergistic protection arises in the simultaneous presence of all four of the additives mentioned, since elimination of any one component leads to inferior ageing performance. It is emphasized that the ZMBI helps to maintain tensile properties but gives inferior compression set (Tables 3 and 4).

Table 3

CHANGE OF TENSILE STRENGTH IN AIR AS STATED (AS % OF UNAGED)

Rubber	*In air at* 100°C.		*In air at* 125°C.	
	28 *days*	56 *days*	7 *days*	14 *days*
Natural rubber, T.M.T. cured (1)	67	35	57	33
Natural rubber, peroxide cured + additives (2)	56	E	63	37
SBR, T.M.T. cured (3)	112	94	—	—
Neoprene WRT (4)	82	77	92	94

E = brittle fracture (elongation less than 20%).

Table 4

CHANGE OF ELONGATION AT BREAK IN AIR AS STATED (AS % OF UNAGED)

Rubber	*In air at* 100°C.		*In air at* 125°C.	
	28 *days*	56 *days*	7 *days*	14 *days*
Natural rubber, T.M.T. cured (1)	61	30	59	41
Natural rubber, peroxide cured + additives (2)	70	E	98	66
SBR, T.M.T. cured (3)	48	29	—	—
Neoprene WRT (4)	66	38	62	27

Mixes used (Tables 3 and 4) were:

1. Smoked sheet 100, zinc oxide 2, stearic acid 2, T.M.T. 3, ZBDC 3, polymerized trimethyl dihydroquinoline 2, ZMBI 2, FEF black 50. Cure 60 minutes at 140°C.
2. Smoked sheet 100, dicumyl peroxide 3, ZMDC 3, lime 2, polymerized trimethyl dihydroquinoline 2, ZMBI 2, FEF black 50. Cure 60 minutes at 140°C.
3. SBR (cold) 100, stearic acid 2, zinc oxide 3, T.M.T. 3, MBTS 1.0, PBN 1.0, FEF black 50, process oil 4.5. Cure 30 minutes at 153°C.
4. Neoprene WRT 100, stearic acid 0.5, zinc oxide 10, magnesia 4.0, NA-22 1.0, PBN 1.0, Aranox 2.0, FEF black 30, process oil 5.0. Cure 15 minutes at 153°C.

The superiority of the new compounding technique for natural rubber is shown in the excellent maintenance of its elongation at break at 125°C. In this it is not only superior to the conventional TMT cured natural rubber but also to Neoprene WRT.

Butyl Rubber

A method of vulcanizing butyl rubber to get improved heat resistance was developed a few years ago by the US Rubber Company and formed the subject of a number of patents. This involves curing with certain types of phenolic resins in the presence of certain halogenated activating agents. Some results of tensile stress-strain properties after ageing in air at 150°C. have been published by the Polymer Corporation[4] using the grade of butyl with the highest unsaturation and comparing with the standard type of GMF cure (Table 5).

Mixes used (Table 5) were:

1. Butyl 400 100, zinc oxide 25, EPC black 30, FEF black 30, Tonox 0.5, GMF 2.0, MBTS 5.0, sulphur 1.5. Cure unstated.
2. Butyl 400 100, zinc oxide 25, EPC black 30, FEF black 30, Resin SP-1045 12, stannous chloride 2.0. Cure unstated.
3. Butyl 400 100, zinc oxide 25, EPC black 30, FEF black 30, Resin SP-1045 7, Neoprene W 10. Cure unstated.

It is clear from these results that the resin cured butyl vulcanizates maintain their tensile strength after exposure to air at 150°C. better than the more conventional GMF ones but that their elongations at break fall off considerably more rapidly.

The Assessment of High Temperature Resistance: Deterioration of Tensile Stress-strain properties when measured at the temperature.

With the increasing use of synthetic rubbers at high temperatures much data has been accumulated about their permanent deterioration by periods of storage at the high temperature by subsequent measurement at room temperature. In fact if the service requirement is to use

the rubberlike properties of the product an assessment should be made of the properties at the temperature before and after storage at the temperature. Most of this data concerning tensile stress-strain properties is of fairly recent origin.

Table 5

CHANGE IN TENSILE STRENGTH AND ELONGATION AT BREAK (AS % OF UNAGED)

Properties after Submission to 150°C.	*Tensile Strength* 1 *day*	4 *days*	7 *days*	*Elongation at Break* 1 *day*	4 *days*	7 *days*
Butyl, GMF cured (1) ..	96	81	68	70	70	65
Butyl, resin and stannous chloride (2)	96	91	75	64	53	39
Butyl, resin and neoprene W (3)	100	96	81	48	35	35

Special Heat Resistant Rubbers

Results of tensile tests carried out at various temperatures in the RABRM laboratories[5] on fluorinated elastomers and for comparison a heat resistant silicone (Silastomer 2472) and an acrylate rubber (Hycar 4021) are as in Tables 6 and 7.

Table 6

TENSILE STRENGTH: EFFECT OF TEST TEMPERATURES

Rubber	*Tensile at 20°C. psi*	*Tensile at 50°C.*	*Temperature (as % of that at 20°C.)* 100°C.	150°C.	200°C.
Kel-F elastomer (1) ..	2,480	22	7	0	—
Hycar 4021 (2) ..	1,550	86	38	23	10
Viton A (3)	1,630	90	31	22	11
Silastomer 2472 (4) ..	830	98	63	54	51
Silastic LS 53 (5) ..	1,040	78	42	26	25

Table 7

ELONGATION AT BREAK: EFFECT OF TEST TEMPERATURES

Rubber	*E.B. % at 20°C.*	*Elongation at Temperature (as % of that at 20°C.)* 50°C.	100°C.	150°C.	200°C.
Kel-F elastomer (1)	200	100	0	0	—
Hycar 4021 (2)	320	63	44	31	19
Viton A (3)	200	90	55	55	30
Silastomer 2472 (4)	260	54	54	39	46
Silastic LS 53 (5)	220	45	50	36	23

Mixes used (Tables 6 and 7) were:

1. Kel-F elastomer 3700 100, precipitated silica 20, zinc oxide 5, Vulcafor VCC 10, Vulcafor EFA 3. Press cure 60 minutes at 125°C., followed by oven cure 16 hours at 100°C.
2. Hycar 4021 100, FEF black 40, stearic acid 1, T.M.T. 2, triethylene tetramine 1.5. Press cure 90 minutes at 153°C.
3. Viton A 100, SRF black 30, zinc oxide 10, dibasic lead phosphite 10, HMDA carbamate 1. Press cure 30 minutes at 135°C., followed by oven cure, step to 200°C., then 24 hours at 200°C.
4. Silastomer 2472, as supplied. Press cure 5 minutes at 115°C., followed by oven cure 1 hour at 150°C. and then 24 hours at 200°C.
5. Silastic LS 53, as supplied. Press cure 5 minutes at 125°C., followed by oven cure 24 hours at 150°C.

It is clear from this that the heat resistant silicone rubber is outstandingly better than the fluorinated rubbers in maintaining its strength measured at high temperature. When measured at room temperature the silicone rubber has a lower strength than the others but when measured at 200°C. it is better than the fluorinated rubbers. Elongation at break is not so clearly differentiated but there is the same general trend in results.

These results demonstrate quite clearly that at 150°C. the fluorinated rubbers Kel-F elastomer and Viton A and the heat resistant silicone 2472 suffer no permanent degradation of tensile strength for periods up to 56 days, the fluorinated silicone LS 53 is showing signs of beginning to break down, whereas the acrylate rubber has degraded quite considerably. Within the 56 days' period the level of tensile strength recorded is entirely dependent upon the temperature chosen to measure the strength for the Kel-F elastomer, Viton A and Silastomer 2472. A similar picture of results is obtained if the elong tions at break are considered.

On the same series of rubbers th degradation of tensile properties a 200°C. for up to 28 days was also carried out and measurements made at 20°C. after the exposure. In addition compression set measurements were made with compression at 150°C. for periods up to 56 days as many of the uses for which they are required require service in compression.

Results are as in Table 9.

This suggests that at 200°C. some deterioration of properties is setting in after 28 days in the case of the Kel-F elastomer which was not observed in the tests at 150°C. Viton A and Silastomer 2472 remain unaffected as in the tests at 150°C. The fluorinated silicone LS 53 shows the same slow rate of deterioration demonstrated at 150°C. Again the effects on elongation at break follow a similar pattern.

These few results demonstrate the clear superiority of the silicone and fluorinated silicone rubbers for use under compression at high temperatures.

Acrylonitrile, Butyl and Neoprene

The effect of temperature on measurement of tensile stress-strain properties of the conventional synthetic rubbers which show some measure of heat resisance has been extensively examined by the Ministry of Supply, Royal Aircraft Establishment[6]. Some of their results are as in Tables 11 and 12.

Mixes used in Tables 11 and 12 were:

1. Hycar 1002 100, SRF black 50, zinc oxide 5, stearic acid 1, polytrimethyl dihydroxyquinoline 2, T.M.T. 3. Cured at 141°C. for 45 minutes.

Table 8

EFFECT OF STORAGE AT 150°C. AND SUBSEQUENT MEASUREMENT AT 100°C.—TENSILE STRENGTH

All results expressed as percentage of the results for the untreated samples measured at 20°C.

Rubber	*T.S. at 20°C. Untreated*	*T.S. at 100°C. after Storage at 150°C. for* 0 *days*	28 *days*	56 *days*	*T.S. at 20°C. after Storage at 150°C. for* 14 *days*	56 *days*
Kel-F elastomer	2,240	4	8	4	103	103
Hycar 4021	1,320	43	9	7	84	37
Viton A	1,390	37	38	31	140	132
Silastomer 2472	860	63	59	75	84	—
Silastic LS 53	820	42	39	31	133	85

Mixes and cures as for Tables 6 and 7.

Table 9

EFFECT OF STORAGE AT 200°C. ON TENSILE STRENGTH MEASURED AT 20°C.

Rubber	*T.S. at 20°C. Untreated*	*T.S. at 20°C. after Storage at 200°C. for* 1 *day*	7 *days*	28 *days*
Kel-F elastomer	2,240	87	77	63
Hycar 4021	1,320	56	12	2
Viton A	1,390	118	114	129
Silastomer 2472	860	93	95	91
Silastic LS 53	820	109	100	89

Mixes and cures as for Tables 6 and 7.

2. Butyl 301 100, HMF black 40, SRF black 20, zinc oxide 5, p-quinone dioxime 2, MBTS 4, sulphur 2. Cured at 153°C. for 90 minutes.
3. Neoprene WRT 100, activated calcium carbonate 100, zinc oxide 10, light calcined magnesia 2, stearic acid 0.5, nickel dibutyl dithiocarbamate 2, p- (p-tolsulphonylamido) diphenylamine 2, 2 mercaptoimidazoline 0.35. Cured at 153°C. for 60 minutes.

Clearly Neoprene WRT is the poorest and Butyl 301 the best, both as regards maintenance of tensile strength and elongation at break at high temperatures.

Table 10

EFFECT OF COMPRESSION AT 150°C. ON COMPRESSION SET

Rubber	Compression Set, %, 1 day at 20°C.	Compression Set, %, after 150°C. for 7 days	14 days	56 days
Kel-F elastomer	34	100	100	100
Hycar 4021	11	96	100	100
Viton A	30	91	100	100
Silastomer 2472	11	27	38	62
Silastic LS 53	13	35	53	66

Mixes and cures as for Tables 6 and 7.

Table 11

EFFECT OF TEMPERATURE OF TEST ON TENSILE STRENGTH

Rubber	Tensile Strength at 20°C. psi	Tensile Strength as % of that at 20°C., measured at 70°C.	100°C.	150°C.	200°C.
Hycar 1002 (1)	2,990	57	34	21	14
Butyl 301 (2)	1,730	57	52	36	19
Neoprene WRT (3)	2,190	27	13	12	8

Table 12

EFFECT OF TEMPERATURE OF TEST ON ELONGATION AT BREAK

Rubber	Elongation at Break at 20°C., %	Elongation at Break, as % of that at 20°C., measured at 70°C.	100°C.	150°C.	200°C.
Hycar 1002 (1)	535	63	47	30	21
Butyl 301 (2)	320	63	66	59	52
Neoprene WRT (3)	790	92	75	52	6

Conclusions

From this brief survey of the effect on a few physical properties of vulcanized rubbers, namely tensile strength, elongation at break and, to a lesser extent, compression set, of high temperatures, it is very clear that in assessing the suitability of a rubber for a particular application not only the permanent breakdown effect due to the high temperatures should be considered, but also the reversible effects exhibited by measuring the properties at the temperatures involved. Other effects such as the presence of oils, solvents or moisture materially affect the rate of deterioration and these also must be carefully considered.

References

[1]'Crosslink,' *Rub. J. Int. Plast.*, 1959, **136**, 777.
[2]RABRM ' C.R.' Report No. 36, 1955.
[3]W. P. Fletcher and S. G. Fogg, *Rubber Age*, 1959, January.
[4]Polymer Corpn., Polysar Technical Report, 1958, No. 7 : 6B.
[5]RABRM ' C.R.' Report No. 63, 1958.
[6]Ministry of Supply, Royal Aircraft Establishment, Technical Note, Chem. 1342, December, 1958.

New Vinyl Plasticizers

Two new epoxy-containing plasticizers for vinyl resins have been introduced by Union Carbide International. Flexol plasticizers 107-D and 163-D, they function both as plasticizers and as vinyl chloride stabilizers. They are said to be completely compatible with vinyl chloride resins even at concentrations as high as 70 parts of plasticizer per 100 parts of resin.

Flexol plasticizer 107-D, chemically di(2-ethyl-hexyl)-4,5-epoxy tetrahydrophthalate, is quite similar in plasticizing properties to dioctyl phthalate. The principal differences, which are attributed to the presence of the epoxy group, are that it is less volatile and has stronger solvating power and a somewhat higher brittle temperature. It imparts long-term stability to vinyl compositions and is highly resistant to fungus attack.

Flexol plasticizer 163-D, chemically di(iso-decyl)4,5-epoxy tetrahydrophthalate, is similar in plasticizing properties and structure to di(iso-decyl) phthalate. However, it is even less volatile and more resistant to extraction by oil than di(iso-decyl) phthalate. The new plasticizer is also a good heat and light stabilizer for vinyl chloride resins and is not susceptible to fungus attack.

Detailed information is available from the Chemicals Department, Union Carbide International Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, NY, USA. London address of Union Carbide Ltd. is 103 Mount Street, London, W.1.

Baker Perkins Ltd. announce the appointment of J. A. F. Halford and J. C. H. Scott as technical representatives for their Plastics Machinery Department. Mr Scott is working from Hatfield ('phone 3643) covering the south. Mr Halford is resident in Sheffield ('phone 33981) covering the north.

Compoflex Co. Ltd.

The Compoflex Co. Ltd., manufacturers of flexible tubing and hoses, announce the opening of a London Warehouse at Angel House, Pentonville Road, London, N.1. (Terminus 0533/4), where stocks will be held to provide speedier distribution to customers in London and the Home Counties. Included in these stocks will be a range of Pirelli long length moulded rubber hoses following an arrangement with the Pirelli Co. of Milan whereby Compoflex will in future undertake the marketing in the UK and Northern Ireland of certain long length hoses made by the Italian Company.

A neat new plastics roll-top bread bin, made by Jury Holloware Ltd., is moulded in three colours in British Resin Products' Styron polystyrene. It has a white roll-lid

VIEWS and REVIEWS

Particle Size Analysis

A. K. GUPTA (Dyestuffs Division, Imperial Chemical Industries Ltd.) has developed a simple apparatus which allows the Andreason pipette technique to be used on suspensions of particles in liquids which are being subjected to centrifugal sedimentation (*'Particle Size Analysis by Sedimentation in a Long-Arm Centrifuge,' J. Applied Chemistry*, 1959, *Vol.* 9, *September*, 487).

By means of the present apparatus particle sizes down to about 0.1μ Stokes' diameter can be measured, and the lower limit could be extended by the use of higher speed of rotation.

The particle size distribution of a suspension of a dyestuff was measured with the apparatus varying both speed and time of centrifuging and compared with as much of the distribution as could be measured by gravity sedimentation only, showed that the two distributions agreed reasonably well. The particle size distribution of a suspension of PVC spheres was also measured, and an electron micrograph showed the spheres to be uniformly of 0.4μ radius. Another figure gives an idea of the reproducibility of the sedimentation results with a given sample. It is adequate for most purposes.

Plastics for Protection Against Corrosion

A. C. Docherty and H. Hughes delivered a paper under the above title to a joint meeting of the Corrosion Group and the Plastics and Polymer Group of the Society of Chemical Industry on November 12 1958.

General

The authors commenced by saying that 'This paper outlines the various ways in which plastics are used, especially in the chemical industry, for protection against corrosion, and before embarking on the survey a few general comments are appropriate.' It is with these remarks that I am chiefly interested because they may cause the industry to take heed of what two experienced engineers have to say on 'generalities.'

'The range of plastics materials available to the engineer is bewildering. Not only can there be so many variations in a basic material, *e.g.* in molecular weight, in plasticizer quantity and type, and in fillers, but each can appear in so many different forms, *e.g.* nylon as cloth, pipe, as bearings, or as a sprayable protective coating. The position is not made any clearer by the prolific use of trade names. New names are always appearing and there is not time to assess fully their properties. This means that design data are often lacking and appropriate standards are not always available.'

But having had their grouse, Messrs Docherty and Hughes relent and express themselves as follows:

'Against this background, plastics are making good progress in engineering work, especially for anti-corrosion. Their properties vary greatly. Tensile strengths may be as high as for steel, but are generally much less—2 to 10,000 psi. This, coupled with high creep, generally limits plastics to low stress applications, unless they are reinforced as in glass fibre laminates, or supported as in coatings and linings. Thermal expansion is high, sometimes 20 times that for steel, and allowance may have to be made for this. Rigidity varies greatly; some are flexible as rubber, while others are stiff, although much less so.'

'Thermal and sound insulation properties are excellent, especially with foams, and plastics are generally good electrical insulators. Their uses for electrical applications, *e.g.* in cable, need no emphasis; this is a very large outlet. Maximum service temperatures are low compared to other constructional materials—about 80°C. for polythene and PVC (typical thermoplastics) and 300°C. for PTFE.

'Mechanical properties are often greatly dependent on temperature, and most plastics are prone to slow deterioration by sunlight and by air, especially at higher temperatures. Corrosion resistance is outstandingly good, especially to those materials which often corrode metals—salt solutions, hydrochloric acid and sulphuric acid. . . .'

And having followed the authors as regards generalities I will leave them to deal with the details of Coatings, Linings, Film, and Tape, and then in their important sections on *Plastics as Constructional Materials*, *Reinforced Plastics*, *Cements*, *Foams*, *Chemical Resistance* and *Testing*.

It is a great pleasure to me to be able to review so comprehensive a review on Plastics for Protection Against Corrosion; or, rather, a small part of it. I can congratulate the authors on their work.

Polymerization by Mastication

'Polymerization by Mastication of Monomers in Cross-Linked Rubbers,' by R. J. Ceresa* and W. F. Watson,† is the title of publication No. 312 of the BRPRA, reprinted from the *IRI Transactions*, No. 1, February 1959.

The mastication of rubber vulcanizates containing monomer has been shown under suitable conditions to cause polymerization of the monomer. The polymer formed is chemically bound to the rubber network. Physical properties of natural rubber-polymethyl methacrylate products are described.

Bulk Polymerization in NR Swollen by Methyl Methacrylate

The above title describes a paper by P. McL. Swift (BRPRA), reprinted from the *Journal of Applied*

*Presently of The National College of Rubber Technology, London.

†Director, The Research Association of British Rubber Manufacturers.

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **DR SCHIDROWITZ**

Chemistry (1958, 8, pp. 803-810) and forming Publication No. 311 of the BRPRA.

Methyl methacrylate absorbed into dry natural rubber has been polymerized under conditions of low heat loss, using as initiator AZBN, alone or in combination with an active peroxide.

With AZBN as sole initiator, some deductions have been made from the change of temperature with time, and as to the change in molecular weight of the polymer formed as the reaction proceeds. No graft polymer is formed.

With the mixed catalyst system, polymerization starts at room temperature. The process has been carried to a semi-technical scale, and some of the properties of the products are given. In general, the materials resemble the corresponding materials prepared in natural rubber latex, but have markedly better hot-tear resistance. About 25% of the polymethylmethacrylate is present as a graft polymer.

The Reaction of Sulphur with Olefines

'The Mechanism of Interaction of Sulphur with (+)-Limonene' forms part of XIII of the series on 'The Reaction of Sulphur and Sulphur Compounds with Olefinic Substances,' by C. G. Moore and M. Porter (BRPRA), and forms Publication No. 312 of the British Rubber Producers Research Association. (Printed in Northern Ireland, Tetrahedron, 1959, Vol. 6, pp. 10 to 15, by the Pergamon Press.)

The reaction of sulphur with (+)—limonene (I) to give the hydrocarbons as demonstrated by Weitkmap, is shown to be uniquely consistent with a recently advanced polar mechanism of olefinic sulphuration. (Weitkamp: *Preprints of papers presented before the Division of Petroleum Chemistry, San Francisco Meeting, April 13-18*, pp. 253; 259; 263. American Chemical Society (1958).)

The Deformation of Foamed Elastics

A paper which appeared originally in the *Journal of Applied Polymer Science* (Vol. 1, No. 1, Pages 107-113, 1959) by A. N. Gent and A. G. Thomas (with an appendix by T. D. Pendle) is 'The Deformation of Foamed Elastic Materials,' and this forms Publication No. 313 of the British Rubber Producers' Research Association.

A theoretical treatment has been given to the paper which predicts the behaviour of a foamed elastic material on the basis of a model consisting of a network of thin threads. Two cases have been considered: (1) small strains, and (2) finite compressions, when the major part of the deformation of the threads is attributed to buckling. The behaviour is given in terms of Young's modulus of the matrix and the density of the foam.

Measurements of the load-deformation relations for small tensile strains and finite compressions are described for NR foams prepared from latex. A wide range of density is covered (0.09–0.57) giving a variation of compression hardness of about 100:1.

Satisfactory agreement with theory has been found for both the cases considered, indicating that the basic concepts of the structure and mode of deformation are correct.

Non-Woven Fabrics

Non-woven fabrics are defined by L. L. Shailer of B. F. Goodrich Co. in I/EC of August 1959 (Vol. 51, No. 5, p. 901) as a continuous web of fibres, treated or processed in a manner other than knitting or weaving, 'which results in a strengthened construction.'

'The output of non-woven fabrics has mushroomed since World War II and currently represents a market well in excess of 100m. per annum. and shows a growth rate of about 25% per annum. Such a growth is highly significant and built upon sound economics and performance coupled with intelligent merchandising and promotion. . . . Equally important is a realization that non-woven fabrics are limited in use and application. . . .'

Binders

The introductory article is followed by 'Mechanics of Non-woven Fabrics' by D. R. Petterson of the Research Division of the Chicopee Manufacturing Corpn., Milltown, N.J., and this by 'Natural and Synthetic Fiber Felts,' by T. J. Gillick, Jun., of the American Felt Co. Both these articles are highly specialized, but the next by Neil H. Sherwood of the Products Application Lab., B. F. Goodrich Chemical Co., Avon Lake, Ohio, contains some information which will interest readers of *RJIP*.

The dry systems are made up of thermoplastic fibres or powders.

Wet Binders are the water-based emulsion systems and these include the polymer latices which are the most versatile and popular of the non-woven binders. Their ease of handling and general freedom from hazard make them attractive. Amongst these are butadiene/acrylonitrile, butadiene/styrene, acrylic, polyvinyl chloride, polyvinyl acetate, polychloroprene, and natural latices. The paper contains a table giving the average properties of saturated non-woven fabric showing the influence of latex binder type on the properties classified according to resilience, heat sealability, softness, washfast, dry cleanable, and colour fastness to heat and light.

Problems

'General applications of non-woven fabrics are now used successfully, but these products are by no means perfect.' A number of very serious problems must be solved if non-woven fabrics are to continue to grow as predicted. These problems are discussed under the classification of Binder Efficiency, Strength, Solvent Solutions, Other Problems, and Colour Problems. The symposium concludes with two papers on *Non-woven Fabrics*, the first on Their Growing Importance to the Textile Industry, by D. C. Nicely of The Chemstrand Corpn., Decatur, Ala., and the second on Their Growing Importance to the Paper Industry. The papers on 'Mechanics,' 'Binders,' and the two last ones ('Textiles,' and 'Paper') were from The Division of Industrial and Engineering Chemistry, Symposium on Non-woven Fabrics, 135th Meeting, Acs., Boston, Mass., April 1959.

PHILIP SCHIDROWITZ

Questions Corner—87

(Second Series)

367. What methods may be used for determining particle size and distribution in synthetic latices?

368. Give brief details of some applications for polyvinyl alcohol.

369. Why are certain solvents added when compounding polyvinyl acetate emulsions?

370. Give some recommendations for drilling, tapping, gear cutting and polishing of nylon.

(Answers next week)

Answers to Questions Corner—86

363. When the water is removed from polyvinyl acetate emulsion the particles pack together forming an apparently continuous film.

Film formation is controlled by the particle size of the emulsion and the molecular weight of the resin and, in addition, plasticization also promotes film formation.

Mechanical properties are mainly a function of the molecular weight of the resin and, generally, the higher the molecular weight the higher the strength.

Polyvinyl acetate, in itself, is a hard and brittle resin but is made soft and flexible by the use of plasticizers which are added in reasonable amounts. If excess is used a tacky film with poor mechanical properties results. PVA is a thermoplastic resin, odourless, tasteless and non-toxic. Films cast from emulsions vary in clarity and gloss depending on the particle size, plasticization, drying conditions and types of emulsifying agents and protective colloids used.

Films are generally tough, abrasion resistant, but with indifferent resilience. Adhesion of the resin is good and although not high for some metals and plastics this may be improved by a short heat treatment.

Electrical properties of the PVA films will vary with the amount of absorbed moisture and, where good electrical properties are required, the susceptibility of polyvinyl acetate to atmospheric conditions makes it unsuitable.

Polyvinyl acetate films are resistant to alkali solutions. The resin is soluble in ketones, esters, chlorinated hydrocarbons and the lower aliphatic hydrocarbons. Films will resist petrol, paraffin, water, white spirit, oils, fats and greases.

364. Polycarbonates may be produced from 4,4′ dihydroxydiphenylalkalines. Some of their interesting properties include high impact strength between temperatures of 135°C. and −100°C., good electrical properties, low water absorption, good transparency and ether resistance.

These polymers are being manufactured by Farbenfabriken Bayer under the trade name of Makrolon, and chiefly intended for injection moulding and extrusion. They are supplied as cylindrical pellets in transparent and opaque colours. Makrolon S is suggested for injection moulding and Makrolon E, with a higher melt viscosity, is considered more suitable for extrusion. Typical mechanical properties are:

Specific gravity—1.20
Tensile strength—8,800-9,500 psi
Flexural strength—15-17,000 psi
Impact strength, notched—200-350 psi
Compressive strength—11-12,000 psi
Volume resistivity, ohm. / cm.—4×10^{15}
Surface resistivity, ohm. / cm.—8×10^{12}
Power factor, 50c./s.—5×10^{-4}
Dielectric strength, Kv./mm.—>100

365. Sisal is the leaf fibre of the plant Agave Sisalana which is widely cultivated in British East Africa, East, West and Portuguese Africa, South and Central America, Indonesia and Haiti.

Early patents were taken out covering the use of sisal as a plastic reinforcing material when it was realized that the contour of the sisal fibre made it most suitable for plastics reinforcement.

The following properties refer to the British East Africa fibre and are taken from data published by the Irish Ropes Ltd.:

Fibre fineness—200 to 400 denier.
Tenacity—4 to 6g./denier.
Elongation—2.5%.
Modulus of elasticity—330g./denier.
Density, of fibre substance—1.5
apparent, of fibre—0.81

Advantages claimed, compared to conventional glass fibre are: Lower cost, lower specific gravity, higher impact strength, and longer shelf life of polyester pre-mix compounds. Disadvantages include: Low flexural strength and modulus, high water absorption, and lower tensile strength.

In addition to chopped form sisal is available in a variety of woven forms from 1½oz./sq. ft. to 6oz./sq. ft.

366. Nylon is a thermoplastic material and compared with metals has a more limited heat conductivity. Machining, however, presents no difficulty provided one remembers one or two simple points. The most satisfactory method is as used for free cutting brass.

Nylon has a high melting point but, in view of the more limited heat conductivity, the development of heat must be reduced to a minimum, especially on thick sections. This is made possible by the use of a suitable coolant (water is usually sufficient), and cutting speeds and feeds.

Too great a local heat often results in sticky and inaccurate surface and care should be taken that the tools are sharp, given sufficient clearance and used at the correct cutting angle. Pressure of the tool should not be too high and vibration of both tools and machine should be avoided.

Nylon can be machined with all cutting tools, viz., turning, shaping, drilling and sawing. It can be ground, and finally finished by wet sanding or polishing.

For turning, engineers lathe tools may be used, but a better finish is obtained, and higher cutting speeds used, if tools are ground with slightly greater clearance and cutting angles than those usually employed with metals.

Nylon has a lower modulus of elasticity and there may be a tendency for the tool to rub, with consequent heat generation, if normal cutting angles and clearances are used.

Tools must be kept sharp, and facing the nose of the tool exactly on the centre of the object being turned. A good surface is obtained when large cutting depth is applied. Screw cutting may be carried out with normal form tools and chasers.

Cutting speeds suggested: 1,000ft./min. Feed, 1ft./min. Depth of cut, $\frac{3}{16}$in.

(More questions next week)

Polly Ester Says . . .

'An enzine is a sort of a flag'

MEN and MATTERS

A Review of People and Events

by George A. Greenwood

A GREAT many people associated with the plastics industry are closing in upon Düsseldorf for the Plastics Exhibition, which opens today (October 17) and lasts until October 25, and the eyes and ears of a great many more will be focused upon an event which, I am told now, is attracting over 650 exhibitors. With what is going to happen there, commercially and socially, I am not here at the moment primarily concerned, but almost fortuitously I have just read an absorbing despatch from this proud German city which has nothing at all to do with the Exhibition *per se*.

It details the story of the rebuilding of Düsseldorf, and its appearance now, living again, larger and more vigorous than ever before, only 14 years after the devastation and desolation suffered during the war.

The article, written by James Brady, says, *inter alia*, that 'today architectural plastic surgery has covered the city's scars with broad streets, superb shops, skyscraper blocks of offices and acres of parks.' He proceeds to describe in detail some of the miracles of this reincarnation, and gives pictures of several of the famous buildings and structures which now adorn the 'Little Palace,' which is the capital of Land North Rhine-Westphalia. From other sources, however, I gather that plastics materials have been extensively used in the reconstruction, especially in the facades of some of the fine buildings in the centre of the city, which, incidentally, has now a population of nearly 700,000, which is 150,000 more than before the war. A factual example appears to be the emporia and the blocks of flats and so on in the Berliner Allee, now a wide modern shopping centre, completely rebuilt since the war. Many concerns of world renown have established their plants in the vicinity. In the city itself are industrial and commercial enterprises for with its own inland harbour and extensive rail systems, it is an important trading centre. Düsseldorf has the reputation of being an elegant city with its boulevards, the Königsallee, the tree-lined ornamental lakes, the cafe terraces, shops, theatres, and the opera house. There is also, of course, the Old Town which has changed little through the centuries. From what I hear, Düsseldorf has something for everybody.

Wallace Exports

Mr F. N. B. Bennett, who has been sales manager of H. W. Wallace and Co. Ltd. since 1952, will be proceeding to the USA this month to further the rapidly expanding export interests of his company. He will be attending the International Rubber Conference in Washington in November in conjunction with Testing Machines Inc. of New York, who represent Wallace in the USA. A number of carefully chosen items of testing equipment, including the Shawbury Curometer, will be on view in the exhibition which is part of the conference.

The name 'Wallace' in connexion with Testing Equipment is now a household word in the rubber industry.

F. N. B. BENNETT

Four years ago very little Wallace equipment was exported. Now the company has official agents in every industrial country in the world and exports exceed home sales. Recently the company was awarded a contract for the supply of two Lambourne constant power abrasion testers and one Dunlop power loss machine for the new Russian tyre factory.

Mr Bennett, who is just 40, started life as an aeronautical engineer. He is an Associate Fellow of the Royal Aeronautical Society, and is firmly of the opinion that a technical background is a very big aid to selling technical products. He advises all young men to study modern languages, including English.

Mainly Personal

There are changes in the directorate of Gordon (Malaya) Rubber Estates. A newcomer is Mr R. G. Cooke, C.B.E., well known already in commercial circles, and Mr Leonard Ian Simpson, A.C.A., has resigned. Mr Simpson retains, I gather, his other numerous posts in the industry.

In mentioning the Russian moon rocket, Lunik 2, in 'Notes of the Week' in our issue of September 19, it was remarked that it was understood there was no truth in the rumour that the George Cohen '600' Group had already launched a rocket to recover the scrap. Mr Felix L. Levy, who is managing director of the company's raw materials division, has taken us up on that.

He writes to say that the rumour is indeed untrue but adds that 'our present policy is to wait until moon rockets are available for reconditioning.' With the launching of Lunik 3 the other day so soon after Lunik 2, it begins to look as though the rocket reconditioning business will be with us a lot sooner than most of us expected.

Polly Ester

My curvaceous colleague, Polly Ester, whose 'sayings' in the Journal now approach the century mark, let me into a secret the other day. She does not, she tells me, think of *all* her pronouncements by herself. Kind friends from this country and overseas send in their suggestions. She mentioned in particular a contributor from the Federation of British Rubber and Allied Manufacturers who shall be nameless; the boys—as she affectionately refers to them—from Bakelite; the Franz Levi rubber factory in Israel; her constant admirer, Mr Hevea de Brasil; and, by no means least, the Journal's world famous cartoonist, J. H. Mulroy. I gather that while she loves her work she is always delighted to receive suggestions.

mulroy's EXPORTALIA

EXPORT LINES

Rubber and Plastics Products Made in Britain

PICTURED on this and the following pages is a representative cross-section of rubber and plastics goods from British manufacturers. The range is comprehensive within the limits of space, but it is, of course, impossible to illustrate more than a fraction of the tremendous variety of products marketed by the British rubber and plastics industries.

AUF diesem und den folgenden Blättern ist eine typische Auswahl von, in Grossbritannien erzeugten, Gummi- und Kunststoffprodukten dargestellt. Das Programm ist innerhalb des zur Verfügung stehenden Rahmens zwar umfangreich, es ist jedoch natürlich unmöglich mehr als einen Bruchteil der enormen Auswahl an Erzeugnissen darzustellen, die von den britischen Kautschuk- und Kunststoffindustrien auf den Markt gebracht werden.

SU questa pagina e sulle seguenti è ritratta una rappresentazione di sezione trasversale di merce di gomma e di plastica di manifattura britannica. E una serie comprensiva entro i limiti di spazio, ma è naturalmente impossible illustrare più di una frazione della enorme varietà di prodotti messi sul mercato dalle industrie britanniche della gomma e della plastica.

LES illustrations sur cette page et les pages suivantes donnent un aperçu représentatif des articles en caoutchouc et en plastique fabriqués en Grande Bretagne. Dans les limites d'espace à notre disposition, nous montrons une gamme étendue, certes, mais il est évidement impossible de donner plus qu'une partie minime de l'immense variété des produits fabriqués par l'industrie britannique du caoutchouc et des plastiques.

The 'Commando' range of soles and heels produced by the company is finding ever-increasing demand in industry, where more and more safety boots are fitted with these hard-wearing products. Illustrated are Commando CBT, a style with a reinforced toe-piece designed with a stitching groove for ease of attachment, and a 'Commando' extra stout heel to match. These products have proved themselves in the rigorous conditions of the coal mines. For everyday town wear underfoot, 'Its-sol-ite' resin rubber is an outstanding material. Illustrated is a new addition to this range, 'Its-sol-ite' units, particularly suitable for use on children's shoes. These moulded soles are suitable for attachment by stitching and cementing and lend themselves to easy and attractive finishing.

ITS Rubber Ltd.
Petersfield, Hants.

The latest addition to the well-known range of 'Blue Riband' products is the LM. 1082 2-gal. watering can which is manufactured in alkathene, is strong and light, supplied with two roses —one fine and one coarse—and the spout is detachable for storage. Colours available are red or green. Other items in the range are: LM. 1080 square bowl size 12 in. x 12 in., manufactured in polythene and, as well as having an attractive appearance, it is ideal for the small sink; the LM. 1060 deep bowl, 14 in. diameter, manufactured in polythene and has useful handles for easy carrying; the LM. 970 2-gal. bucket, height 9¾ in., diameter 10¾in., manufactured in polythene; and the LM. 1035 lid which fits the LM. 970 2-gal. bucket. All these items are obtainable in colours of yellow, blue, green, white or red, with the exception of the watering can which, as stated, is in red or green only.

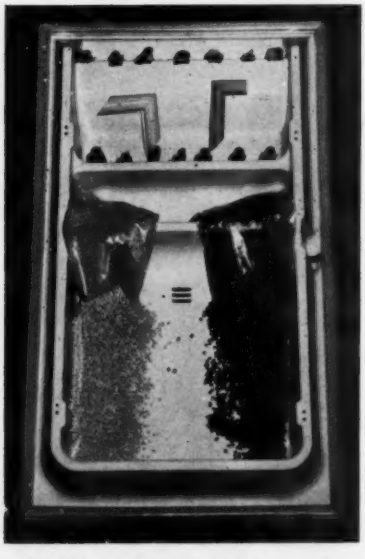
London Moulders (Plastics) Ltd.
364/6 Buckingham Avenue
Trading Estate
Slough, Bucks

A new range of starter battery containers is being produced by the compa Known as the Lorival ' Lightweight,' they are designed to meet the modern nee for light, compact batteries. This range results from several years' research an practical test. During this period over a quarter of a million batteries made i lightweight containers have been in service on popular makes of automobile The Lorival plant for the production of hard rubber moulded battery containe is one of the largest and most modern in the world and has been completely built and equipped since 1945. The new ' Lightweight ' range, although at present limited in extent, includes popular sizes for British and Continental automobile Two standard sizes are designed for tractor batteries.

United Ebonite and Lorival Ltd.
Little Lever
Bolton, Lancashire
England

Bendy toys meet all the requirements of the ideal toy, being practically unbreakable, soft and pliable. They can be made to look as though they are in a state of suspended animation, enabling the child to give the toy a personality and position it to characterize the mood of their play acting. They excite the imagination with the many poses into which they can be bent. This bendability is effected by a soft wire skeleton moulded into hygienic foam rubber, in bright colours which can be readily washed to preserve their appearance. The three items illustrated are Maxie the Daxie, Popeye and Chico.

Newfeld Ltd.
Newfoam Works
Spelthorne Lane
Ashford, Middx

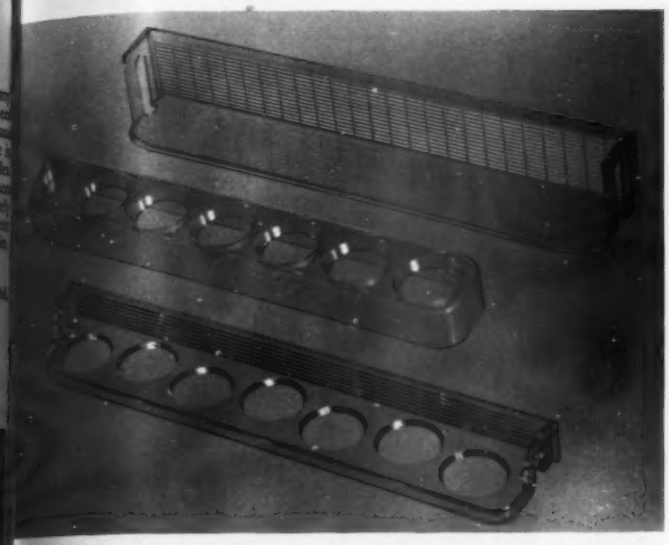


The illustration shows the company's door seal in position on a refrigerator door panel, with a variety of sections for these seals. The PVC door seal is tasteless, odourless, styrene-resistant and has maximum recovery properties incorporated. Shown also is some 'Li-Lex ' PVC chip. The company manufactures a wide range of seals and trims for the principal manufacturers of domestic appliances in the United Kingdom.

P. B. Cow (Slough) Ltd.
5 Falmouth Road
Trading Estate
Slough, Bucks

The low coefficient of friction of ' Ferobestos ' asbestos reinforced plastic when lubricated by water, combined with its great wear resistance and high dimensional stability, make it an ideal material for stern tube and rudder post bearings on ships—the same properties bring it to the forefront in rolling mill bearings, where the water is also used as a coolant for the roll necks, and where the shock-absorbing properties of ' Ferobestos ' are of importance in rolling sections. Its light weight, strength rot chemical and exposure resistance, make it an ideal material for very many other industrial applications. Illustrated is a small selection of ' Ferobestos ' components.

J. W. Roberts Ltd.
Chorley New Road
Horwich, Bolton



'Lustrex' polystyrene manufactured by the company is a high quality material which lends itself to a large variety of applications. The refrigerator fittings illustrated were fabricated by the Streetley Manufacturing Co. Ltd. for Electrolux Ltd. The grades of 'Lustrex' available are: T3, T7, and T11, specially toughened; T6 designed for the extrusion of sheet; T5, for shoe heels; UVL, ultra-violet resistant grade which has been developed for diffusers, louvres and shades for fluorescent lighting assemblies. The company also manufactures foamed polystyrene for use in the building, packaging and refrigeration industries.

Monsanto Chemicals Ltd.
Monsanto House
10-18 Victoria Street
London, S.W.1

This weatherproof jacket manufactured in Fablon PVC material is one of the latest developments in the PVC garment industry. The company also manufactures a wide range of thermoplastic sheeting and film and it supplies a range of materials, including polypropylene, for the packaging industry. Another interesting product of the group is the 'Cubitainer' liquid and semi-solid container. This is composed of a polythene inner and a cardboard outer and is an economical method of transporting and dispersing liquids.

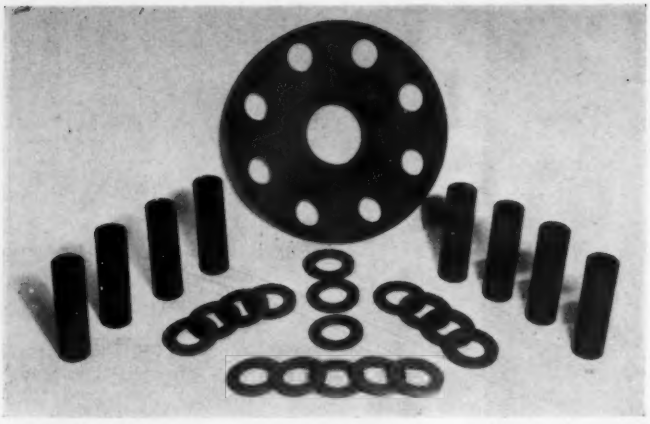
Commercial Plastics Ltd.
73 Grosvenor Suare
London, W.1

The company has been engaged in the manufacture of adhesives for half a century. Starting with the supply of natural rubber solutions intended mainly for the motor car and footwear industries, the company has continually extended its range so as to take advantage of the potentialities of new materials and to widen the field of application of adhesives. Among the items currently produced with the aid of these adhesives are aircraft, radio, television and electrical equipment generally, motor cars, ships, furniture, houses, factories and buildings of all kinds, boots and shoes, toys and a host of light engineering items. The firm's adhesives were used for the all-metal door parts and kick panels in the illustrated railway car.

Surridges Patents Ltd.
Elmers End
Beckenham, Kent

This is a section of 2000mm. wide 14-ply rubber Terylene conveyor belting, specially designed and constructed for ore-carrying on a mammoth Soviet conveyor installation. The cover thicknesses are 6 mm. top inclusive of a nylon transcord breaker and a 2 mm. back. The maximum working tension of this belting is 59 tons. The company is well-known for the quality of its belting and has had much success on the export market. Large quantities are also supplied to the National Coal Board.

BTR Industries Ltd.
Belting Division
Herga House
Vincent Square
London, S.W.1

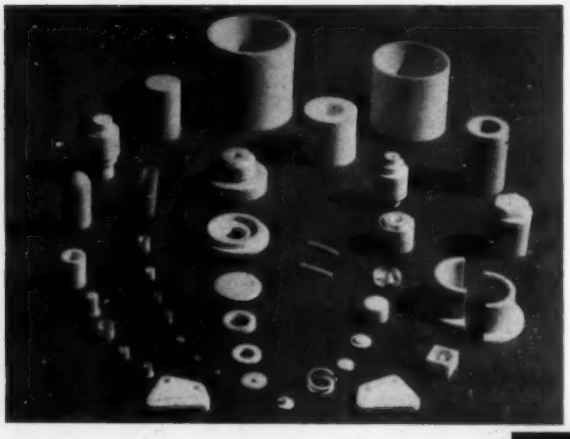


'Tufnol' is used for a wide variety of engineering components in many parts of the world. In the Middle East, gaskets, washers and bolt jackets of Tufnol are assembled into oil pipeline couplings, where they are successfully preventing corrosion due to electrolytic action. These Tufnol components are giving trouble-free service although they are in constant contact with oil and are exposed to the rigorous climatic conditions of the desert. Tufnol is also used extensively for ships' stern tube and rudder bearings, etc.

Tufnol Ltd.
Perry Bar
Birmingham

The company has the largest output of glass fibre boats outside America and more than 50% are exported to over 60 countries throughout the world. The range includes 7ft. 6in., 9ft., 12ft. and 15ft. rowing outboard dinghies, 9ft., 12ft. and 15ft. motor and sailing dinghies, 12ft. and 15ft. fast outboard runabouts, 20ft. single and twin screw inboard and outboard powered cabin cruisers, and 36ft. ships lifeboats accommodating 145 persons each (as illustrated). Glass fibre reinforced polyester resin construction is particularly well suited for marine use, enabling hulls to be moulded in one piece with no joints or fastenings to leak, being pigmented to the desired colour and so requiring no painting, unaffected by climatic extremes or marine borers, free from rot, corrosion and galvanic attack, and comparatively easy to repair.

W. and J. Tod Ltd.
Ferrybridge
Weymouth
Dorset



'Permaflon' PTFE processed by the company combines the properties of chemical resistance, wide working temperature range, low co-efficient of friction and almost nothing can stick to it; it is one of the best solid dielectrics, completely non-tracking, non-inflammable, tough and in its thinner forms is flexible, non-wettable and impervious to moisture and the effects of weathering over long periods. Small machined parts can be made from sheet, cylinder or rods as required. Machining to within reasonable limits is possible but not generally to closer than ± .003 inches.

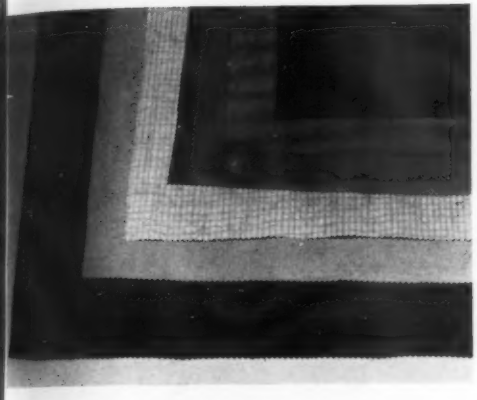
Permali Ltd.
Bristol Road
Gloucester

One of the most important applications of translucent plastics sheeting is for natural lighting in roof structures of various kinds. The suitability of 'Unilux' for this purpose rests on its high degree of translucency, its ability to withstand all climatic conditions, its combination of light weight and strength and the fact that sheets are virtually unlimited in length. Coloured 'Unilux' can be used purely decoratively, or to obtain a combination of natural lighting and pleasing colour effects. In tropical areas, colour has an important practical advantage in that it may be utilised to reduce the intensity of sunlight. Particularly suitable in this respect is 'Unilux' in Monastral Green, which has been in strong demand for export since its introduction recently. A variety of grades of this product is available.

U.A.M. Overseas Ltd.
Tolpits
Watford, Herts.

The company's wide range of products includes a selection of hot water bottles in various sizes. Those shown are the 'Slumbersound 2, Submarine' bottle, available in several colours, with an all-rubber closure, and the 'Lamb' one of the company's 'Countryside' series of bottles for children. Rubber plugs and sockets in the 'Duraplug' range cover all normal ratings and are designed for both domestic and industrial applications.

W. W. Haffenden Ltd.
Richborough Rubber Works
Sandwich
Kent

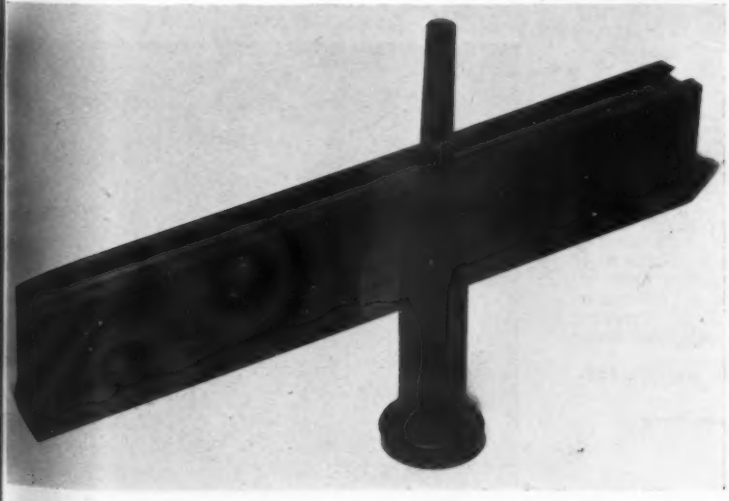


A new range of plastic/synthetic fibre laminations is being manufactured by the company. Using the latest equipment from the US, the difficulties of obtaining a good adhesion with sheeting onto a woven synthetic fibre such as nylon or terylene have been eliminated. The company's lamination process obtains a good adhesion between the interstices of the netting. One of the most recent additions to the range is a lamination of polythene to hessian netting which has exceptional strength and durability, and has the added attraction that it is cheap in price compared with other materials for covering, etc., applications.

J. Mandelberg and Co. (Rubber) Ltd.
Albion Works
Pendleton
Salford, 6, Lancs.

The Dunlopillo Division of the group is well known for its latex foam products. The wide range of items produced by the division includes the scatter cushions illustrated. These are available in plain and striped covers. The construction of Dunlopillo products allows a constant circulation of air through the foam, thus making items like these cushions extremely suitable for both tropical and arctic climates.

Dunlop Rubber Co. Ltd.
Dunlopillo Division
Rochdale
Lancs.



The company has served industry for many years in the supply of specialized rubber components which are manufactured mainly to individual specifications. Illustrated are a milking machine inflation and a rice mill brake block. Other items are produced for the motor car, aircraft and domestic machinery industries. A speciality is made of rubber to metal bonding.

The Avon India Rubber Co. Ltd.
Industrial Rubber Products Division
Melksham
Wilts.

'Minibrix' building construction kits are made fro a high-quality rubber. They incorporate a wide range components—bricks, pillars, roofs, windows, doors a angle pieces, etc. All pieces are standard and sets can added to when desired so that buildings of any magnitu can be made. The series incorporates an interesti interlocking device which can be quickly picked by th child and it ensures a firm structure. Formerly packe in conventional box-shaped cartons, the sets are no marketed in attractive cylinders as illustrated.

Minibrix Ltd.
Petersfield
Hants.

Pressure ventilated clothing manufactured by the company has been widely used by the United Kingdom Atomic Energy Authority for some years and is now finding increasing applications in industry where it is used not only for protection against radiation hazards but also in the wider field where protection against dangerous chemicals is required. Made of PVC, these suits incorporate high frequency welded seams; each garment is pressure tested before it leaves the factory.

Plysu Products Ltd.
Woburn Sands
Bletchley, Bucks

Illustrated is a selection of body trim parts, specia designed for the automobile industry, made in 'Royalit nitrile thermoplastic by the North British Rubber C Ltd., which is an affiliate of the United States Rubber C An increasing number of manufacturers are using 'Royalit fascia crash pads backed with foam as an extra safe precaution. The material is a gum plastic manufactur from a plastic copolymer and a synthetic rubber. Ava able in varying degrees of hardness from soft flexib to rigid sheet, it offers a combination of both streng and toughness in various finishes, grains and colours.

US Rubber International (Gt. Britain) Ltd.
62-64 Horseferry Road
London, S.W.1

This well-known and old-established company is at present engaged in the development, production and marketing of a range of industrial products incorporating high-grade natural and synthetic rubber blends. A large variety of hoses designed for oil suction and discharge use is manufactured. The HBS hose illustrated is made from fine synthetic rubber blends and is suitable for use with a wide range of petroleum products. The lining is designed to give maximum oil resistance and the cover also gives good resistance to oil, weather and general abrasion. The hose can be used with heated heavy fractions and continuous high operating temperatures can be sustained. Another interesting recent addition to the company's range is lightweight road tanker hose.

George Angus and Co. Ltd.
P.O. Box 139
Newcastle upon Tyne

The most important feature of the company's new 'Trencher' boot, which has been designed to meet the special requirements of industrial and public service users, is its non-metallic safety digging plate made from a special compound of natural and synthetic rubber. This carefully designed digging plate prevents boots from being ruined by the constant use of shovels and spades and is ribbed to ensure good contact. The plate is tough enough to outlast the life of the boot. The upper also has an additional reinforcement on the inner side of the leg to give extra protection and strength.

BTR Industries Ltd.
Footwear Division
Herga House
Vincent Square
London, S.W.1

Bottles blow moulded from polypropylene show excellent resistance to a wide range of foodstuffs and chemicals and is very tough and resilient. It makes possible the moulding of bottles with a thin wall section, giving considerable economies combined with adequate protection and strength. At this stage polypropylene bottles are likely to be mainly suitable for powdered products, but it is probable that the range of potential uses will be greatly extended as development work continues.

Metal Box Co. Ltd.
Plastics Group
37 Baker Street
London, W.1

The 'LI-LO' children's inflatable dinghy is manufactured in special quality rubberized fabric with rope holds and a safety line. It is available in orange/blue. The product is only intended for use in shallow, calm water, *i.e.* pools on the beach, children's pools, etc. The 'LI-LO' 'New Wonder' full-length air-bed is cross-reeded down the centre for extra comfort. This is a revised and improved version of the company's previous season's model. Size: deflated 80in. x 30in. approximately; inflated 73in. x 24in. approximately. It is available in green or blue.

P. B. Cow and Co. Ltd.
12 Hay Hill
Berkeley Square
London, W.1

A progressive step in this technique for the mending of tyre covers has been made by the company, with its introduction of nylon tyre plasters. Made entirely from nylon and rubber, these plasters for passenger-size tyre repairs are only half the weight and thickness of standard cord plasters, so that disturbance of the tyre's balance is kept to a minimum. They are, however, much more durable than ordinary plasters, as the physical strength of nylon cord is greater than rayon or standard tyre cord. Each plaster is individually moulded to ensure a complete feather edge which blends perfectly into the cover and will not pinch the tube. These flexible plasters are designed in one shape to fit any part of the cover, into which they will rest without creasing.

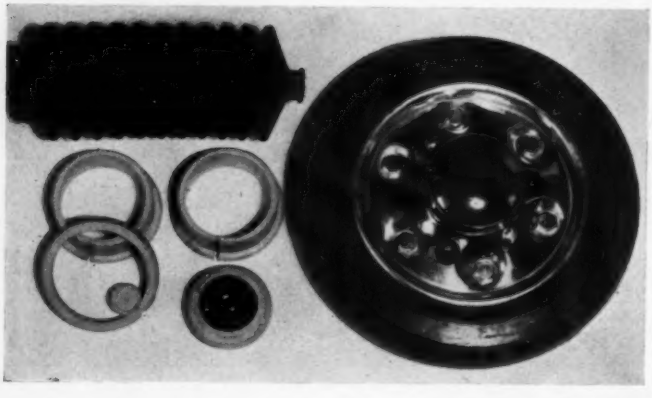
Romac Industries Ltd.
The Hyde
London, N.W.9

A badminton shoe, a yachting shoe and cricket boot are typical examples of the range of sports footwear produced which also includes fencing shoes and tennis shoes. The badminton and squash shoe is in duplex white laced-to-toe with a nylon insert, and embossed foxing to the edge of the vulcanized crepe soles. The yachting shoe has a duplex blue rot-proofed canvas upper with an extra strong large embossed rubber toe cap. The cricket boot has a duplex white canvas upper incorporating protective sponge ankle guards and rubber toe cap. All three have a sponge cushion insole and arch support.

Greengate and Irwell Rubber Co. Ltd.
Footwear Division, Hardman Street
Radcliffe, Manchester

The ' Forsum ' and ' Blue Spot ' golf balls shown here are two of this company's best-known lines. They have for long commanded a wide and ready sale. Although the company is concerned mainly with manufacturing golf balls and golf clubs, captive and parachute balls are also produced. Another speciality is the production of golf balls branded with the customer's own name.

Sparkbrook Golf Ball Co. Ltd.
295 Highgate Road
Sparkbrook, Birmingham, 12



This company has established a very high reputation for the manufacture of mouldings in sponge and solid rubber, extrusions and mechanical goods to customers' own particular requirements, as well as being able to offer a comprehensive range of standard components such as brake blocks, basin plugs, cistern pulls, door stops, etc. Wheels for industrial and domestic use are a speciality and a wide range is offered from a 14-in. diameter barrow wheel to a 1-in. diameter castor bowl. The company also has a large new plastics factory, specialising in the moulding, extrusion and fabrication of thermo-plastic materials for the refrigerator, motor-car and medical industries.

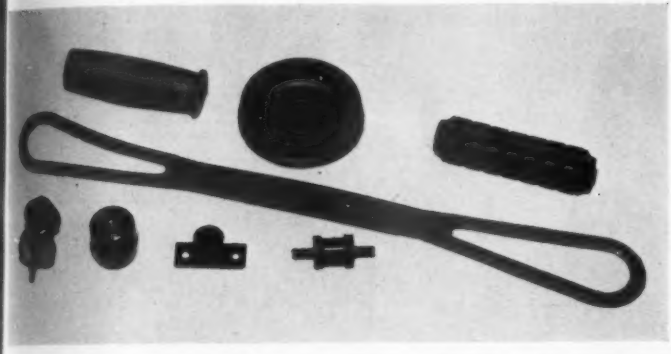
Capon Heaton and Co. Ltd.
Hazelwell Mills
Stirchley
Birmingham, 30

The company manufactures plastic piping from ¼ in. to 6 in. diameter. The low density polythene tubing conforms to BS1972/53 and 1973/53, and can be joined using standard compression fittings. High tensile polythene tubing is offered for greater rigidity and higher temperatures and pressures. Rigid PVC piping is made in three grades and a range of PVC fittings is available. Other products include conveyor belting, suction and delivery hoses, roller coverings, mouldings and extrusions, elastic thread and rainwear.

David Moseley and Sons Ltd.
Chapelfield Works,
Ardwick
Manchester, 12

The range of 'Epophen' epoxide resins and hardeners for pattern making provides innumerable compositions from which can be selected those most suitable in terms of flexural, tensile, shear and impact strength; hardness, thermal conductivity, wear-resistance and flexibility, etc., required in the finished tool. The company not only supplies suitable resin/hardener compositions to companies requiring to manufacture their own tools, but also manufactures tools of all types in its own plastic tooling department. Illustrated is a foundry pattern of a locomotive wheel measuring 4 ft. in diameter.

Leicester, Lovell and Co. Ltd.
North Baddesley
Southampton

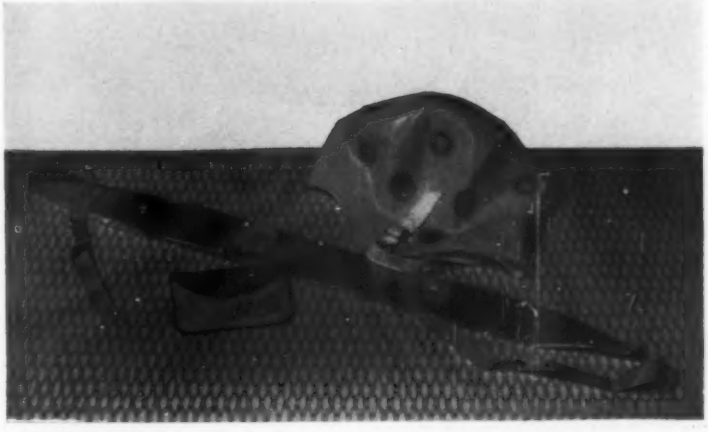


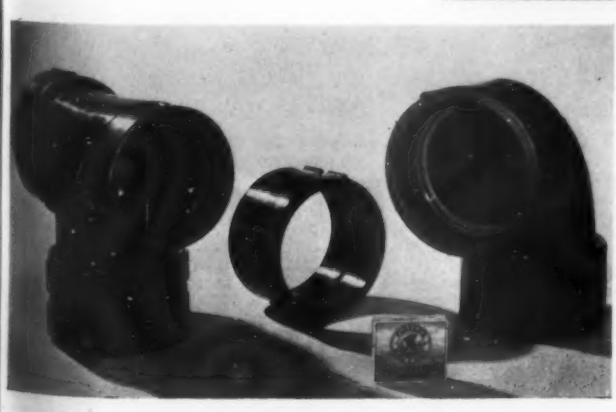
The company, which is associated with Rubber Bonders Ltd., produces a wide range of general mouldings for the automotive, electrical and allied industries, sponge sections for door seals, etc., and general extrusions including windscreens and short length hoses. It also specializes in the bonding of rubber to metal including instrument mountings, machinery mountings, flexible couplings, etc. Amongst the items illustrated are a 'Spandit' book carrier, a pedal rubber, a handlebar grip, and flexible couplings.

Empire Rubber Co.
Dunstable
Beds.

'Trityl' bathing caps, decorated by a new method, are available in a number of different designs. An interesting feature of the caps in this range is that they have a built-in perfume. The 'Floral Poppet' is a headcover decorated with cotton artificial flowers in three colours and leaves enveloped in polythene. The polythene is permanently pleated to give automatic folding. Each 'Floral Poppet' is packed in a two-tone plastics studded case.

William Oliver's (Rubber) Ltd.
132a Blackhorse Lane
London, E.17





New 6-in. diameter fittings injection moulded in high-impact Geon PVC, and specifically designed for the oil industry for handling crude oil, effluent and allied materials, are manufactured by Durapipe and Fittings Ltd., West Drayton, Middx. Well known for their PVC, British Geon also produce oil-resistant Hycar nitrile rubbers and adhesives, which find many industrial applications.

British Geon Ltd.
Devonshire House
Piccadilly, London, W.1

For over a century the company has maintained an international reputation for design and quality in the manufacture of rubber components for all types of rolling stock, both at home and overseas. Products which play a large part in achieving maximum safety on modern railway systems include buffing and draw springs, draft gears, vacuum brake hosepipes and cylinder components, Flexitor rubber springing for vestibule gangways and sensitive edges for power-operated doors. A recent development is the manufacture of Mini car bonded rubber suspensions, and other types of bogie suspensions are in course of development. The illustrated mounting has a steel centre plate.

George Spencer Moulton and Co. Ltd.
Bradford-on-Avon
Wilts

Extra-light ' Stick-a-Soles ' have been specially designed by the company for feather-weight fashion shoes. They are manufactured in an entirely new quality and are invisible, in wear, even on the daintiest shoe. ' Bantam ' heels, another new product designed to meet the demand for a hard-wearing top piece, are for high-heeled shoes. The celluloid backing, softened by a cellulose activator, gives adhesion, and when reinforced with suitable rivets the ' Bantam ' is fitted to the shoe simply and effectively.

Phillips Patents Ltd.
Western Avenue
Acton, London, W.3

The solings illustrated are, *left to right*, ' Wave Line,' ' Fine Wave Line,' both in gum rubber, and ' Corrugated Crepe Patter ' and ' Very Fine Fented Sheeting.' The gum material is very popular at the present time, its lightness and flexibility being suitable for many modern shoe lines. The two latter solings, in the company's ' Conway ' material, are easy to work from the manufacturers' point of view and they have good hard-wearing qualities. Colours available in the latter material are natural, black, brown and mushroom.

Harboro' Rubber Co. Ltd.
Dainite Mills
Market Harborough

The range of finger cones manufactured by the company under the trade mark ' Mermaid ' is shown in the illustration. These have been carefully designed by long experience to cover the needs of all types of male and female users in office or factory. Made from best quality rubber—brick red in appearance—they are offered at an attractive price, either boxed or in bulk.

Caton Ltd.
Mermaid House
70 St. Thomas Street
London, S.E.1

Illustrated are a few of the many items which the company regularly supplies to the motor car, aircraft and domestic machinery industries. A speciality is made of rubber to metal bonding and the company has special facilities for the design of rubber components to meet the most arduous operational requirements. Components are manufactured mainly to individual specifications. The Industrial Rubber Products Division incorporates George Spencer Moulton and Co. Ltd.

Avon India Rubber Co. Ltd.
Industrial Rubber Products Division
Melksham, Wilts.

The company has this year introduced a number of new sizes of its rubber holders for test tubes, bottles, ampoules and other objects, variations in the outer dimensions of which are taken up by the elasticity of the rubber. These holders are manufactured either in black synthetic rubber or in red softer type organic rubber. In addition to the above the company produces a great variety of laboratory, hospital and veterinary equipment in rubber, synthetic rubber (including silicone rubber) and sterilizable plastics materials, including vinyl tubing from 0.5 mm. bore, disposable blood transfusion sets and veterinary artificial insemination requisites.

Esco (Rubber) Ltd.
2 Stothard Place
Bishopsgate, London, E.C.2

In addition to the company's well-known range of hot water bottles and specialized rubber components for various industries in both natural and synthetic rubber a range of toys for pets is being produced. A few of the items from this range are illustrated : the full range includes dog balls, rings, balls with bell, bones, knuckle bones, crackle bones, puppy biscuits, dumb-bells and mice in both high grade floating quality and commercial quality rubber. All of these items are offered in red, blue, green, yellow and drab.

Reliance Rubber Co. Ltd.
Cremone Works
Cleveland Road
Hemel Hempstead, Herts.

The ' Suba-Luxe ' hot water bottles in two sizes—large and cot—have a soft fabric fixed cover which gives a high degree of heat retention. Also incorporated are the company's ' Suba-seal ' principle which ensures safety in filling and closing, and a patented rubber shroud which welds together the bottle and its cover. Final closure is by means of a zip-fastener. The ' Staywarm ' complete baby feeding unit comprises a ' Suba Warma ' outer container, a ' Suba-Seal ' boilable polythene bottle and a polythene measure.

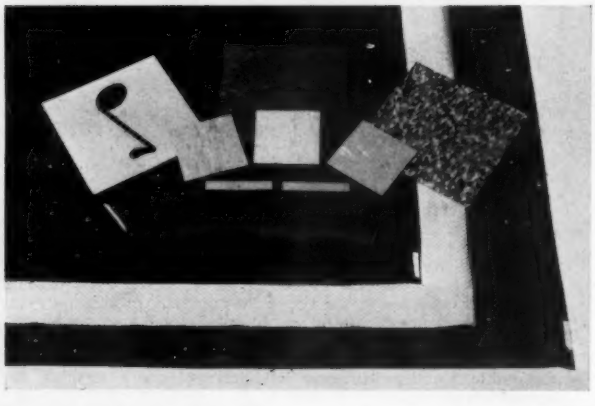
William Freeman and Co. Ltd.
Subaseal Works
Peel Street
Barnsley

The company specializes in the manufacture of infants' feeder teats, feeder sets and soothers, etc. A large variety of shapes and sizes is made and special designs can be produced according to customers' specifications. All of the company's products are guaranteed a storage life of three years in any climate. Illustrated are 'Grip-tight' soothers and feed teats, a 'Grip-tight' glass bottle (horizontal), and a 'Freflo' polythene bottle which is of particular interest as it can be boiled, and sealed with a reversible screw top incorporating a disc, thus making it ideal for travelling with feeds ready made, etc.

Lewis Woolf Ltd.
144 Oakfield Road
Selly Oak, Birmingham

The company's products include multi-coloured balls sold under the trade name 'Solo'; low density blown sponge mouldings of all types for the automobile and furniture industries, etc.; and high-grade dipped products including meteorological balloons up to 100 grammes, oxygen and air bags, tobacco pouch linings, and a variety of special products. A special feature of the company's blown sponge moulding process is the low cost of short runs, and the fact that more complex designs are possible compared with latex or plastics foams.

Lea Bridge Rubber Works Ltd.
Lea Bridge
London, E.5



The company's floor tile range includes 'De Luxe' and 'Terrazzo,' of almost solid vinyl; three grades of vinyl asbestos Marleyflex 1000 and 1200, and the 'Homelay' tiles in four colour styles; and the four grades of standard thermoplastic. Other products based on vinyl are the wall tiles, flexible skirting, flexible and rigid stairnosing, MarleyFlor sheet floor covering, Marleyrail (handrail), and the flexible surfacing materials, Marleyfilm, Marleydecor, and Super Marleydecor which are now self-adhesive, the backing being protected by a polythene film, and in a new wide range of colours and patterns.

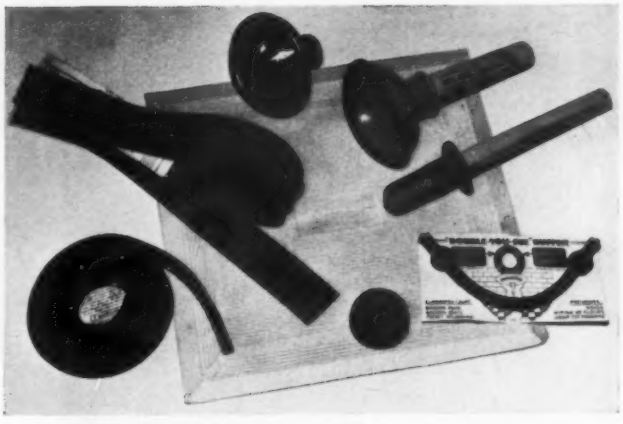
The Marley Tile Co. Ltd.
London Road
Riverhead,
Sevenoaks, Kent

The James North Group is one of the world's largest manufacturers of PVC industrial safety gloves and clothing and foul weather garments. PVC-coated gloves and clothing for industrial and domestic protection of all kinds are exported all over the world. Illustrated is a selection of PVC and loop-pile fabric gloves for various industrial hazards, and 'Glovelies Featherflex' for domestic use.

James North Export Ltd.
Kirkman House,
54a Tottenham Court Road
London, W.1

'Easykleen' products illustrated are a rubber watering can rose, a force cup and a rubber mat. Also illustrated are a 'Busy-body' rubber stove cleaner, a 'Poppin' towel holder, a 'Double-you-See' buffer, and 'Bux-Strip' senior and junior draught excluders. The watering can roses have a rubber body and solid copper jet plate, which can be easily removed for cleaning and just as easily refitted. Being rustless, these roses give years of service and are of particular interest to the tobacco-growing industry, to which great numbers have already been sold. The Poppin towel and article holder can be fixed, without tools, and will hold anything from a towel to a broomstick. The rubber brush is for applying caustic solution to cookers and the like, for removing grease, etc. The rubber mats are available in four sizes and have a non-slip surface, for sinks, tables, and general purposes.

'B and W' Patents Ltd.
Tillgray Works
Booths Hill Road
Lymm
Cheshire



Veedip Ltd., and their associated company, Lewis Gilder and Co. Ltd., have become recognized specialists in the manufacture and marketing of rubber gloves designed to meet a wide range of application. Illustrated are but four of the extensive types of gloves and gauntlets offered by these two companies, namely, a surgeon's glove, a crepe-reinforced acid resistant industrial gauntlet, a grey abrasion-resistant industrial glove and a neoprene protective gauntlet as supplied to Atomic Research Establishments. Veedip Ltd. also manufacture an expanded polystyrene material, under the trade name 'Isocolor'—a product which excels for all types of insulation.

Veedip Ltd.
St. Helens Works
Slough, Bucks

Illustrated are some of the company's range of baby soothers, baby bottle teats, valves, eye-droppers, 'Moor-field' teats, 'Vaxine' caps, etc., in many different shapes. These items are marketed under the name of 'Husha-bye.' On the right is shown one of the firm's dolly outfits, consisting of dolly soother, feeding bottle, hot-water bottle, potty and pants.

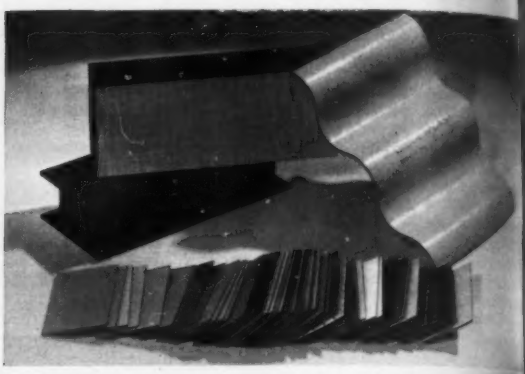
P. H. Douglas and Co. Ltd.
16 Commercial Street
Cheltenham

The company's well-known golf balls are exported to all the golf-playing countries of the world. Of excellent quality, these balls have an added attraction—to assist in card marking identification they are marked with the four card symbols, hearts, clubs, diamonds, and spades. The illustration shows Penfold patented balls in a presentation pack.

Golf Ball Developments Ltd.
Bromford Lane
Ward End
Birmingham 8

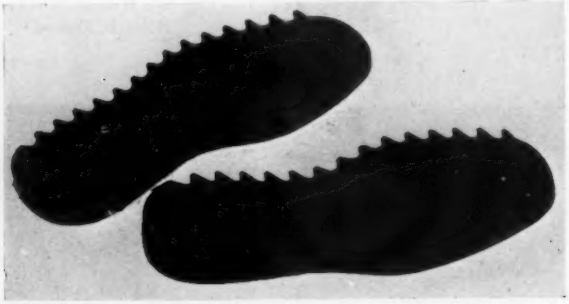
The illustration incorporates an 'Ariel Balloon Treat' (ref. 256), a carnival novelty with three balloons already attached; an 'Ariel Party Pack' (ref. 277) with which the company is having some success in Canada; a miniature 'Easi-Pump' (ref. 214), a smaller model of the original version, containing 18 balloons; and a suregrip house glove counter demonstrator, a silent salesman which is supplied with a try-on sylkette-lined glove. The company is well known for the quality of both its gloves and balloons.

London Rubber Co. Ltd.
Hall Lane
Chingford
London, E.4



'Decorplast' decorative laminated plastics sheets are availab in an extensive range of colours and patterns. The material i durable and is resistant to the effects of most food acids, fru juices, spirits, fats, oils, and boiling water. It is hygienic and ca easily be cleaned with a damp cloth. All colours and patterns ar light fast. 'Corroplast' corrugated laminated plastics roofing sheets, with many applications, are available in three natura colours, brown, terracotta, and brunswick green, and—for exterio use—with stove enamelled finishes. 'Holoplast' laminated plas tics structural panels, which can be filled with insulation materials are used for office partitions and for exterior use in curtain walling For exterior use the panel can be supplied in two integral colours of natural brown and terracotta, or with the 'Decorplast' surface which can also be applied for interior use. A special range of 'Decorplast' colours and patterns is available for this purpos

Holoplast Ltd.
New Hythe
Near Maidstone
Kent

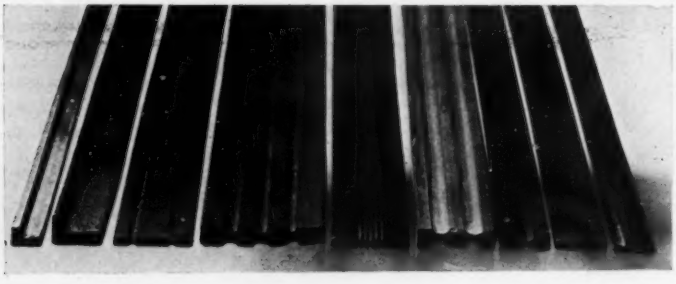


This billow sole, which is known in America as the 'Ripp sole, is now made under licence in the UK by Sussex Rubber Developed from the war-time paratrooper's boot, this sole sold over 5,000,000 pairs in the US during 1958, and the figures for this year are even higher. The ripples absorb vibration and hea shock, encourage a longer and springier stride, provide traction distribute the body's weight more evenly, and are obviously ideally suitable, not only for golf, hiking, etc., but also for those whose occupation keeps them on their feet for long periods. The soles are available in black, brown and translucent mixes.

Sussex Rubber Co. Ltd.
School Road
London, N.W.10

The widely-known 'Starlite' non-intercellular packing material is shown in the illustration. The range offers soft commercial to heavy density sponge including qualities specially prepared for damping pads, saddle numnahs, face masks, non-silver staining packing and toilet sponges. Also manufactured by the company are sponge mouldings, cord, tubings and 'Airtred' (illustrated), the sponge-backed rubber flooring.

St. Albans Rubber Co. Ltd.
The Camp
St. Albans, Herts.



Ebonite Dividing Strip is specially designed for terrazzo floors and is produced in a wide range of sections. Terrazzo floor layers prefer it as it is easy to handle and to lay. With ebonite there is a superior decorative effect in the contrast between lighter coloured terrazzo and the black strip and another advantage is that ebonite wears at the same rate as Terrazzo.

Hunter and Hardy Ltd.
Dawson Street
Hyde, Cheshire

The 'Marigold' two-tone glove was launched in the domestic market with great success at the beginning of 1959. It comes in bright contemporary colours, either red/yellow or blue/yellow, and a new manufacturing technique gives greater resistance to grease and detergents and thus a longer life. Two-tone gloves are presented in a three-colour window box of up-to-date design, and the size range extends from 6½ to 9 rising by half sizes. The 'Marguerite' glove is another important addition to the range and caters especially for the demand for a popular priced glove with outer roughened surface and also inner suedette lining. Of generous cuff length it is available in three sizes, small, medium and large, and is presented in a printed carton on which instructions for use are printed in four languages.

J. Allen Rubber Co. Ltd.
Whitecroft, Lydney
Gloucestershire

Made from 'Alkathene' and developed in consultation with farming authorities, the 'Poly-Pika' is being manufactured for a variety of uses. It is specially recommended for fruit picking and horticultural uses and can be supplied with shoulder straps for slinging, or in an unperforated form for use as a feeding trough. The handles are removable and the containers are designed to stack. The company claims that it can be run over by a farm tractor without sustaining any damage, and it further states that, when turned upside down, the Poly-Pika is at a nice height and comfortable to sit on.

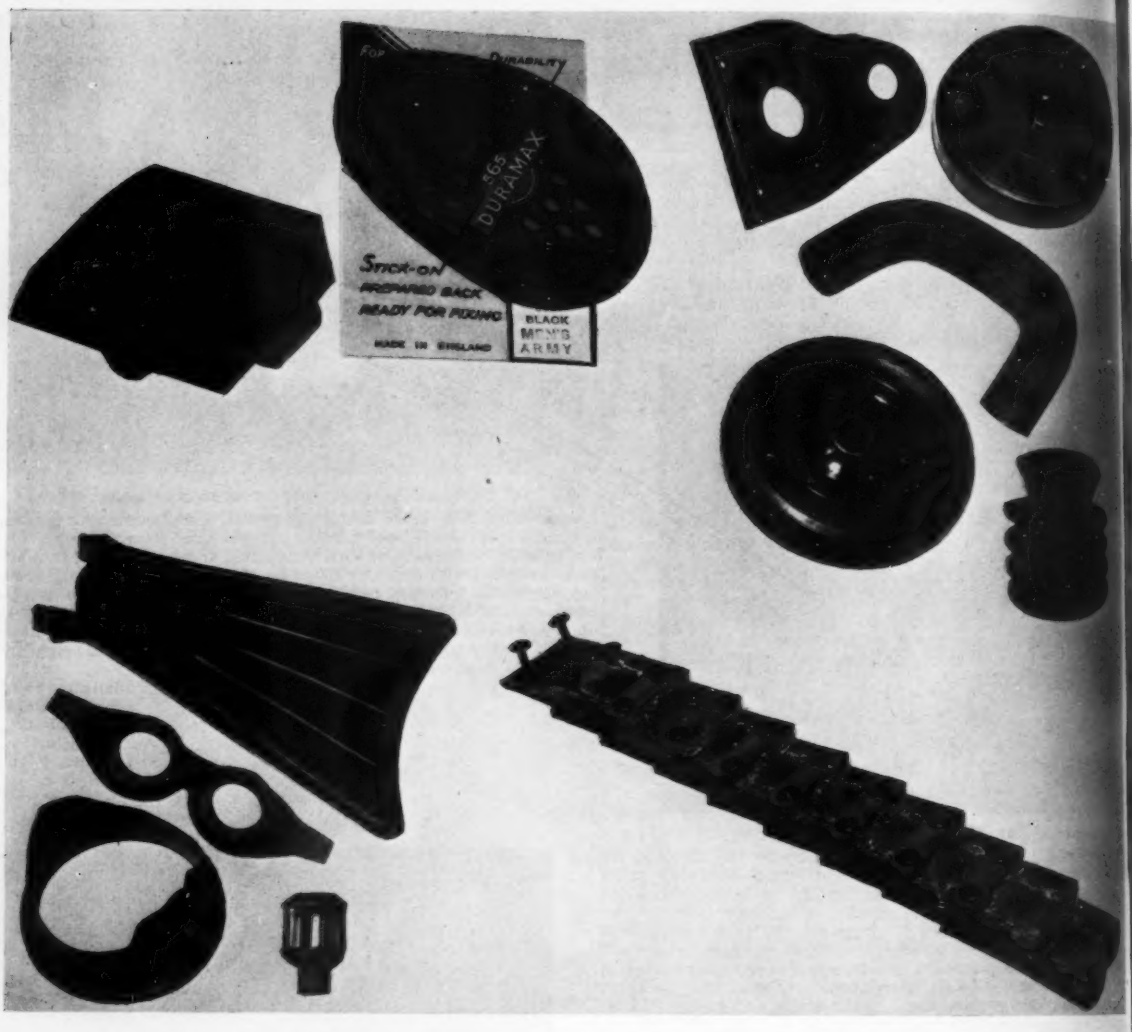
Insulators Ltd.
Peopold Road
Angel Road
Edmonton
London, N.18

Nylon chain is being offered to industry by the company for light positive drive applications. This chain obviously offers considerable scope not only in the rapidly expanding electronics field but also in many other branches of industry, notably: the food industry, horticulture, chemicals, pharmaceutical, and electrical. Currently being offered at 8 mm. pitch, this chain will stand a static load of 5 lb. The company also produces a range of coil bobbins for miniature transformers. These, like the chain components, are manufactured by the firm's well-known 'Mini-moulding' process.

George Goodman Ltd.
Robin Hood Lane
Hall Green
Birmingham, 28

The Bex car washer, consisting of a polythene bucket, a length of tubing which is attached to the bottom of the bucket, and a sponge, enables the whole of a car to be washed with only one bucket of water. The bucket of water is placed on the roof of the car and the force of gravity keeps the sponge dampened. When the bucket is not required for car washing, the hose can be removed and a plug attachment on the inside of the bucket placed in the hole The hose is 11 ft. long.

Halex Division of the British Xylonite Co. Ltd.
Highams Park
London, E.4



Rubber products of many types are offered by the company for widely differing trades in various countries throughout the world. A full range of rubber soles, heels, stick-on-soles, sheets of soling and top-piecing material, are available in different designs in black or brown, also resin-rubber sheeting and the increasingly popular 'Maxilite' resin-rubber lightweight stick-on-soles. The mechanical rubber department offers components for widely diverse industries. Increasing numbers of manufacturers in the radio, television, refrigerator, motor and bottling trades, etc., are turning to the company for all types of rubber components.

Duramax Ltd.
Marlborough Works
Marlborough Road
London, N.19

The illustration is indicative of the extensive range of extrusions manufactured by this rapidly expanding division of the Geo. H. Hughes organization. The division is also well known for its precision mouldings and for the bonding of these materials to various metals. The range of extrusions is extensive covering car, domestic and industrial fields. The company has been associated with the manufacture of wheels and castors for many years, and a speciality of this division is producing mouldings and extrusions to customers' own requirements and specifications in both natural and synthetic rubbers.

Geo. H. Hughes Ltd.
Rubber Mechanicals Division
Edgemond Avenue
Birmingham, 24

The company specializes in the manufacture of hose and mechanical rubber components in various natural and synthetic compounds. Shaped hose connexions are constructed with reinforcing canvas inserted throughout and a wide range is available for automobiles, tractors and industrial engines. Hundreds of varying sizes of flexible fabric coupling discs are used throughout the world. These have considerable tensile strength and flexibility in the transmission of power between engines and driven units. Solid rubber wheels are manufactured, from 2in. diameter to 16in., for all portable equipment, and amongst numerous other rubber products may be mentioned: moulded bellows, extrusions, mud-flaps and drain testing rings.

Hermetic Rubber Co. Ltd.
Ryland Street
Birmingham 16

A product of the company is the Brammer variable speed belt which is built up by means of links, giving a wide shallow belt resisting side pressure which at the same time is extremely flexible. It has in addition the advantages of vee-link belts in that it can be fitted to drives without the necessity of dismantling bearings or machinery parts, and can be stocked in coils and joined at will to make belts of any length. The belting is made of heat and oil-resistant material, and is fitted with special steel plates which resist side pressure and may be easily attached to the belt.

H. Brammer and Co. Ltd.
Hudson Road
Leeds, 9

Already proving a best seller in the original knee length variety, the 'Avon Stonehenge' seamless wellington is now available in the three-quarter thigh length required by fishermen. The skirt is manufactured of high quality materials and designed to give maximum flexibility and comfort. The company also manufactures a wide range of soling and heeling materials well-known for their quality. A recent addition are 'Mannide' pre-moulded sandal units available in various qualities including translucent.

Avon Footwear Sales Ltd.
Bridgend
Glam.

The company specializes in the manufacture of rubber components for applications requiring a consistently high standard of material, quality finish and close dimensional accuracy. Included in a wide range of products in natural, synthetic and silicone rubbers are 'O' Rings, mouldings, extrusions and rubber to metal bondings. A varied selection of compounds is available for different applications and a complete range of Prescolastik Silicone grades is produced. In addition, fabrics such as glasscloth, nylon and Terylene are coated with silicone to produce diaphragms and gaskets, etc. Now available are several grades of Viton combining heat resistance and oil resistance, and a new synthetic rubber offering resistance to Skydrol hydraulic fluid 500.

Precision Rubbers Ltd.
Bagworth
Leicester

The rubber resin coke hod is specially suitable for use in the modern home, being extremely tough, light and easy to handle with no risk of damage to floor coverings or furniture. Also produced by the division is a range of hot water bottles. These are available in a wide range of attractive designs and colours, the one illustrated being the 'Renown' type, which incorporates an extra wide neck for filling, *top right*.

Dunlop Rubber Co. Ltd.
General Rubber Goods Division
Cambridge Street
Manchester

The 'Aquafort' swim fins produced by the company combine exceptional toughness with flexibility for underwater swimming. Diving gloves from the same range are designed for warmth and protection with sure grip under water. The company has played a leading part in the development of diving dress and it has achieved considerable success with its equipment. A feature of these is an air reservoir for a perfect seal. Squash balls are available for both slow and medium speeds.

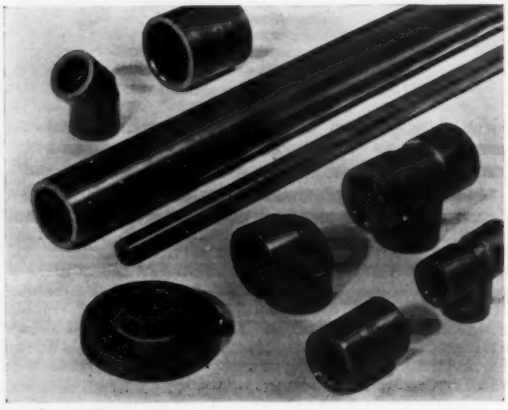
Dunlop Sports Co. Ltd.
Allington House
London, S.W.1

PTFE flexible hoses manufactured by the company combine good flexing qualities, high temperature and pressure ranges, resistance to most chemicals, a low co-efficient of friction, good non-stick properties and lightweight construction. The fittings illustrated are a swivelling re-usable gauge unit, a patented re-usable female union (cane seat pattern), and a patented re-usable fixed male.

William Rose Ltd.
Hilyn Works
Lockfield Avenue
Brimsdown
Enfield, Middx.

New to the company's range are vinyl rainwater goods. These comprise gutters, down pipes and fittings that need no painting and will never corrode. The advantages of these pipes and fittings for building are their lightness and indefinite life, making them an excellent substitution for conventional cast-iron products. The company also produces a wide range of floor and wall tiles and PVC sheet materials.

The Marley Tile Co. Ltd.
London Road
Riverhead
Sevenoaks, Kent



' Silverflow ' pipes and fittings combine inherent qualities of corrosion resistance, ease of installation, low weight and resilience and resistance to shock loading. These products, which are manufactured from unplasticized PVC, have exremely wide industrial application—for example in the building, chemical, petroleum, plating, metal, textile and atomic energy fields. ' Silverflow ' fittings can be joined to ' Silverflow ' pipe by a variety of methods—flanging, heat welding, solvent welding or threading (B.S.21 Taper Thread). The threaded ' Silverflow ' pipe fittings are designed with the threads recessed to prevent damage to them during shipment. This type of thread design prevents cross threading and provides a protective collar to the unused threads.

BTR Industries Ltd.
Linings and Coverings Division
Herga House
Vincent Square
London, S.W.1

This new-look plastics raincoat is made from ' Stor-Decor.' Completely opaque, it comes in a variety of multi colours, with matching hat and optional belt. It also incorporates welt pockets, turn-back cuffs and pearl buttons. The colours available are red/black, green/black and yellow/black, all with white backgrounds. The approximate retail price is 25s. 11d. The company is well known for its sheet materials, embossings and designs. All plastics sheets are subjected to special tests to ensure that they meet BSI requirements, prior to being released to manufacturers or the public.

Storey Bros. and Co. Ltd.
White Cross
Lancaster

The 'Vit-Air' Mark IV dust respirator has been designed for the Home Office to give protection against dusts which cause pulmonary diseases such as silicosis and asbestosis. It is a light, comfortable dust respirator of high efficiency and low respiratory resistance and is made in several sizes. Also illustrated is the 'Vit-Air' hose respirator. This breathing apparatus is suitable for the protection of men who have to enter enclosed spaces where the atmosphere is known to be, or is suspected to be, toxic. Breathing is performed through a tube, the far extremity of which is anchored in the open air. The breathing tube is made in standard 30ft. lengths and two lengths can be connected together without rendering breathing too difficult.

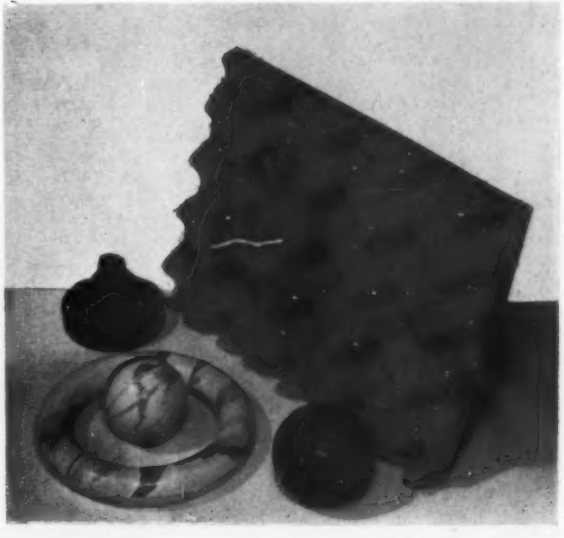
J. E. Baxter and Co. Ltd.
Respirator Assembly Factory
Leyland, Lancs

The company has long been known for its toys of which a very wide range is available. The good design of these rubber dolls, together with their bright colouring and, where appropriate, clear lacquer finish, gives them an instant appeal. Each toy is supplied in a polythene pack with a printed header card. Also manufactured is the 'Vintage' series of almost unbreakable wheel toys in slush cast latex and provided with wooden wheels.

The Chad Valley Co. Ltd.
Wrekin Toy Works
Wellington, Salops

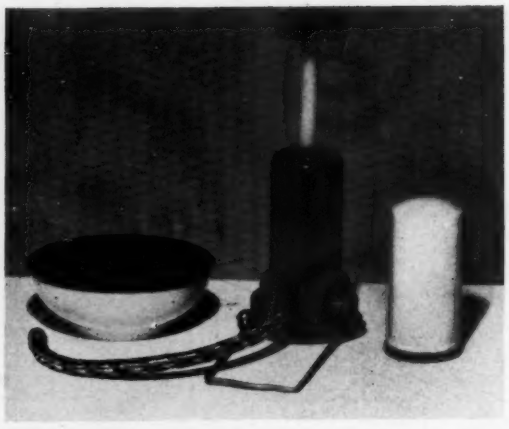
The items illustrated represent a few of the products bearing the well-known name 'Sorbo.' The company manufactures sponge rubber sheeting, rods and gaskets, floor coverings, perambulators, invalid carriages, industrial truck and cycle tyres, moulded mechanicals in sponge and solid rubber, upholstery, ambulance equipment and surgical requirements, play balls, kneeling mats, concrete expansion jointing, toilet sponges. Mouldings and extrusions for the automobile and other transport —electrical—refrigeration and engineering industries are made in natural and synthetic rubbers. Also manufactured is 'Sorboprene,' a new foamed cellular plastic of light weight.

Sorbo Ltd.
Woking
Surrey



Additions to the wide range of hot-water bottles manufactured by the company include several with non-burn surfaces in attractive designs and a variety of soft textured finishes, also dual types with ribbed front and smooth back. The bottles illustrated are the 'Cumfy,' the 'Cosy' and the 'Heatex.' A considerable range of mats is produced for domestic use including draining boards, draining mats, tea trays and deep ribbed table mats.

The Cannon Rubber Manufacturers Ltd.
Cannon Works
Ashley Road
Tottenham, London, N.17

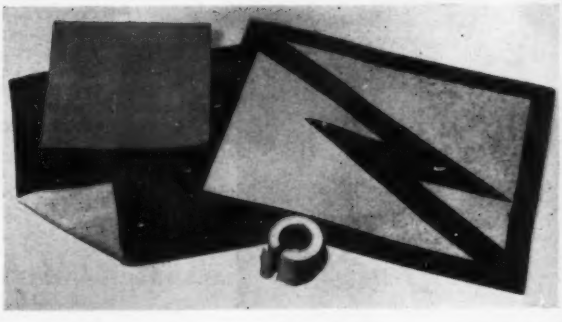


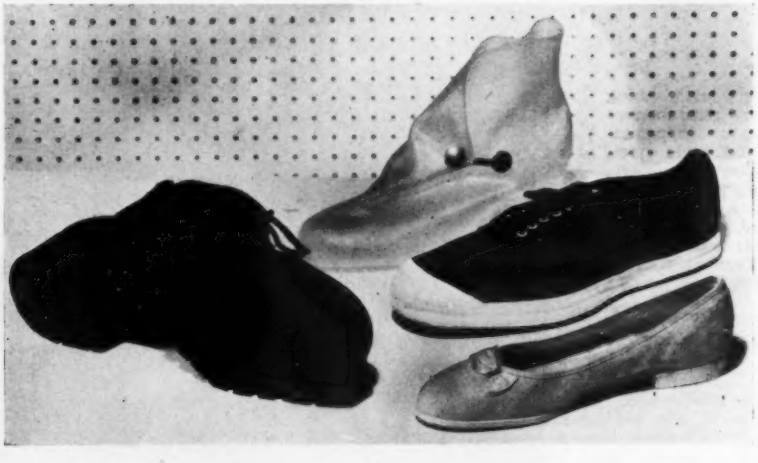
The company manufactures the range of 'Volatex' latex foam pillows, a wide selection of sponge rubber bath mats and church kneelers, footwear soling materials in sheets, cut soles, moulded and fabricated units, sponge rubber sheets and cut gaskets in both inter-communicating and non-intercommunicating types, and sponge and solid rubber moulded mechanicals. Also produced is a range of VC knee pads used extensively by miners in the UK, but equally effective for any jobs involving kneeling, and 'Volaprene' (polyether and polyester) foam supplied in blocks, sheets, cushions, carpet underlay and fabricated parts, insulation lining and combined to a variety of fabrics.

Volcrepe Ltd.
VC Works
Glossop
Derbyshire

The shaving bowl is made from paper-filled urea formaldehyde, and can be supplied in any colour or shade, with lid and base in contrasting colours, as illustrated. The cycle pump, in two sizes, standard or major, hand- or foot-operated, has a self-lubricating nylon piston rod, a cup washer of oil-resisting rubber, and a removable connector. Weights of the two models are 5 and 6 oz. respectively. The shaving stick body is made in paper-filled urea formaldehyde and the base in wood-filled urea formaldehyde.

Universal Metal Products Ltd.
Salford, 6
Lancs.





The 'Turntable' coat, style W.2930, [illegible] made from lightweight, double-textured [illegible] rayon with a rubber interlining. It comes [illegible] coffee, green, light blue and red, all [illegible] white, and in the following lengths: 42½ [illegible] 44½ in., 45½ in. and 47½ in. The wholesale price is £3 3s. 3d., and retail, £4 19s. 6d. The coat is completely washable and is also reversible and has a matching hat and belt. It is front buttoning and has raglan sleeves with two slit pockets on both the striped and plain ways of the coat.

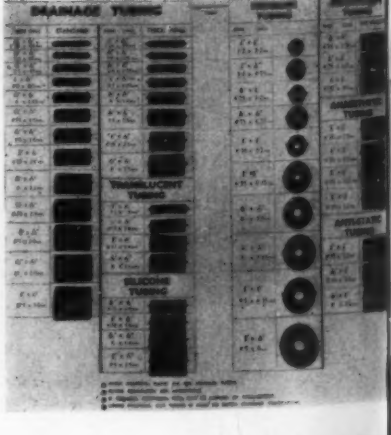
Dannimac Ltd.
35 Dutton Street
Manchester, 3

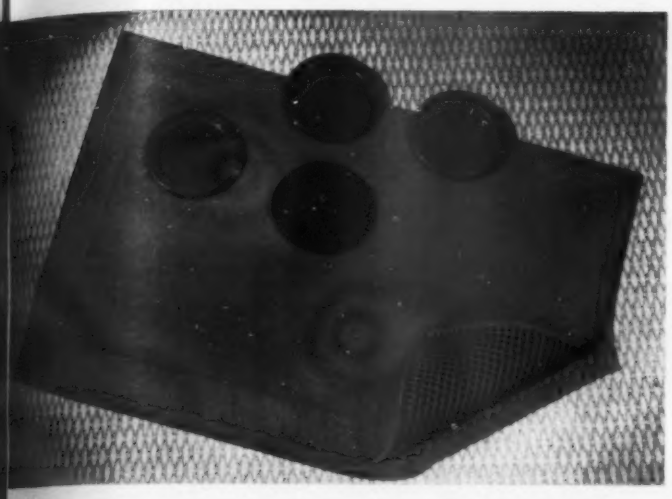
The leather 'Safetymaster' boot, with safety toecap (B.S.I. Specifications 953, Grade 1), has a moulded rubber sole and heel. The 'Shoeglove' plastic overboot incorporates a nylon mesh heel reinforcement. It is available in natural and smoke. The 'Magister' plus navy yachting shoe, in nylon with 'Dunlopillo' insole, has a spun nylon counter and toepiece and a special honeycomb slip-resistant sole. Available for both men and women. The 'Cowslip' coffee strawcloth slip-on court has a white moulded sole and heel, and is available in Multi-print mesh, beige mesh and white sailcloth.

Dunlop Footwear Ltd.
Speke
Liverpool, 19

One of the company's specialities is tubing for hospital purposes. A wide range is manufactured for the following applications: drainage, standard and thick-wall; pure rubber tubing for blood transfusion; anti-static tubing for use in operating theatres; tubing of various colours for use with medical gases; silicone tubing for drainage, etc.; and plastic tubing for a variety of applications. Sample cards, as illustrated, containing cuttings of the above mentioned qualities are distributed through the company's agents abroad, to importers and to hospitals.

J. G. Franklin and Sons Ltd.
Birkbeck Works
London, E.8





The range of 'Cannon-Aid' rubber housewares manufactured by the company has been expanded to include selections of trays and car and household mats. Illustrated are four 'Cocktail Coasters' (drip mats) which are available in 12 brilliant colours in an attractive carton. Also shown is the new 'Cumfeet' anti-fatigue mat which will be available shortly. Household mat designs include brush pile, scraper, fluted and honeycomb.

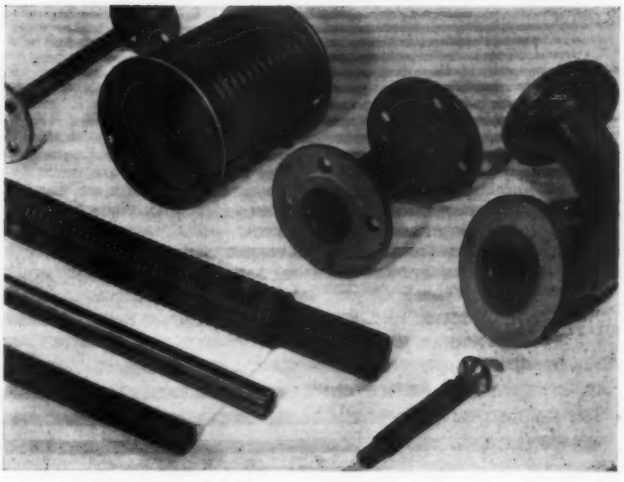
The Cannon Rubber Manufacturers Ltd.
Ashley Road
Tottenham, London, N.17

Built to an especially robust specification, the latest of the company's tyres, the 'Giant,' has been designed to meet the heavy demands made by ever-faster load movements. The principal features of its construction are: continuous ribs for even wear and high mileage, staggered pattern for continuous grip, wide, deep, non-skid tread and reinforced high-tenacity rayon carcass. The company produces a range of tyres of various types and also a variety of other products.

John Bull Rubber Co. Ltd.
Evington Valley Mills
Leicester

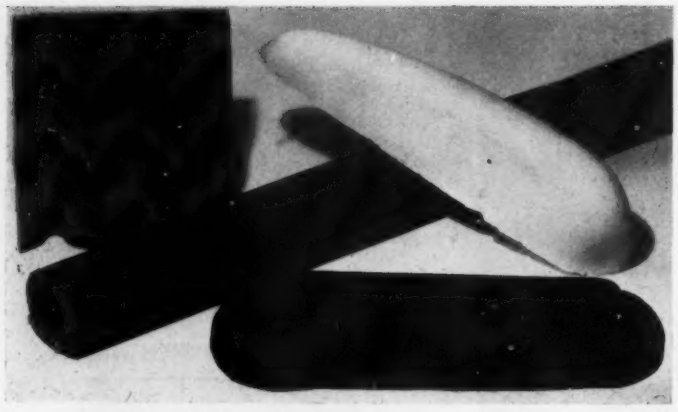
The company's 'Junior' pillow is a recent addition to the Super Foam range, and its handy size and attractive presentation have already made an impression. The larger D.11 pillow is an established favourite overseas and sales continue to increase. Both the D.11 and 'Junior' carry the British Good Housekeeping Certificate of Guarantee. Also illustrated is a reversible cushion B.3203. The design features 'graduated compressibility,' which incorporates larger cavities in the centre of the cushion to give maximum comfort, with smaller cavities towards the sides to increase resilience. Of particular importance are the very strong outer walls.

Bintex Ltd.
Harrogate
Yorkshire



Flexible PTFE fittings and mild and stainless steel PTFE-lined fittings are made by the company. The ability of PTFE to resist a wide range of temperatures, and inertness to most known chemicals give it high utility in both industrial and aircraft applications. Typical examples are the use of 'Fluoroflex' high-pressure pipes in the DH Comet 4B and circuits conducting highly corrosive fluids in the chemical and allied fields.

BTR Industries Ltd.
Linings, Coverings & Aero Products Division
Herga House
Vincent Square
London, S.W.1

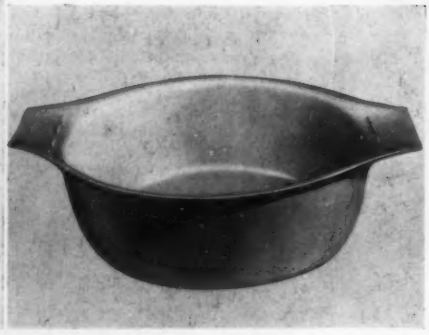


Flexible foams are manufactured by the comp in solid or profiled forms for upholstery, etc. Al produced are ' do it yourself ' kits of pipe lagging i polyester foam, arm pads in vacuum formed PVC with polyester foam support, and polyester moulded arm pads. The company's wide range also includes the well-known ' Foamedge ' vinyl coated flexible plastic foam weatherstrip and dust seal in plain and self-adhesive finish and a series of narrow gauge f oams for lamination to fabric and board for the shoe industry and to plastic sheets for car head linings, etc. Polyester mouldings include refrigerator egg tray nests, mop heads, and packing pieces, etc.

Lintafoam (Sales) Ltd.
P.O. Box No. 25
High Wycombe
Bucks.

The company recently introduced a new ' non crush ' suction and delivery hose. The wheel or track of a heavily laden vehicle can pass over this hose without causing damage. Immediately the load is removed the hose returns to its original shape and full suction or pressure delivery continues. The new hose is made from 1½-in. to 3-in. diameter. Lengths up to 60 ft. can be provided if required. The hose will operate continuously at full suction and is satisfactory for continuous pressure services up to 100 psi.

William Warne and Co. Ltd.
India Rubber Mills
Barking
Essex



One of the latest additions to the company's extensive range of Ekco ' Gold Seal ' domestic ware is the new ' Super-Bowl.' The conventional ' bowl shape ' is supplemented by built-in handgrips which also form lips for pouring. Moulded in rigid polythene, the ' Super-Bowl ' is available in a choice of lemon, blue, green and red. The Ekco ' Gold Seal ' pedal bin is of attractive design, with the base in white polythene and the polystyrene lid in a choice of red, blue, primrose and green. Silent in use and light in weight, it has a capacity of three gallons and can be easily emptied.

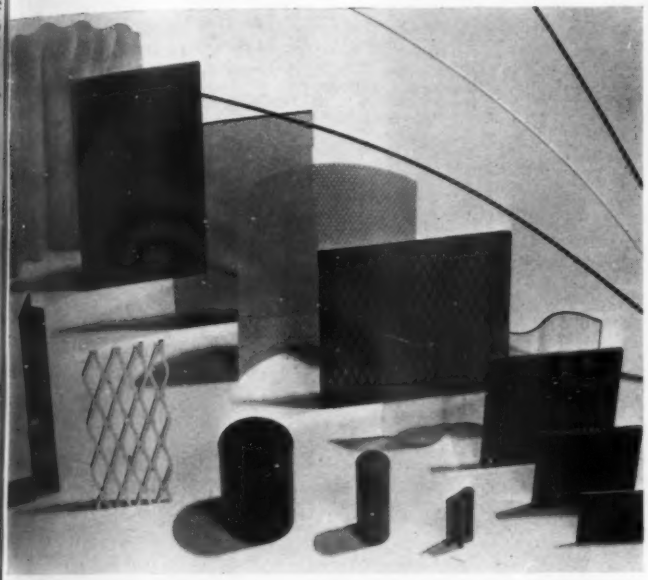
Ekco Plastics Ltd.
Ekco Works
Southend-on-Sea
Essex

A portable wardrobe which can be folded flat for easy transportation is now being produced by Jekmoth Home Store Ltd., Lillie Road, London, S.W.6, using a printed cotton fabric with a permanent washable glaze finish achieved by coating it with Geon PVC. A wardrobe such as this is subjected to considerable wear, especially at the creases, but the high quality of Geon PVC has made these wardrobes rot-proof and hardwearing. The fabric is made by Wadalex Ltd., 89 Oxford Street, Manchester, 1

British Geon Ltd.
Devonshire House
Piccadilly
London, W.1

Each year a considerable percentage of the large number of products manufactured by the company at Wolverhampton are produced for the export market. These include tyres from the company's comprehensive tyre range for all forms of wheeled transport, industrial rubber products—conveyor belting, hoses, fenders, V-belts and the like—aviation equipment, shoe products, Pliofilm and adhesives.

Goodyear Tyre and Rubber Co. (Great Britain) Ltd.
Wolverhampton



Illustrated are various forms of the company's ' Cobex.' This material is a rigid, unplasticized PVC which is notable for its high chemical resistance up to fairly high temperatures and good impact strength. It also offers considerable ease of fabrication and hence a low manufacturing cost. ' Cobex ' has found many applications in industry, including the construction of fans and fume cupboards, as well as fume-extraction ducting. Laminated with ' Velbex ' it has been employed as a tank lining.

BX Plastics Ltd.
Highams Station Avenue
London, E.4

The shower spray, sink swillers and solings illustrated are only a small selection of the company's range of domestic and consumer products. The ' Steeltip,' a new line which has only recently been introduced, is a toppice of unique design, and the combination of steel and rubber make it exceptionally hard wearing.

Hunter and Hardy Ltd.
Dawson Street
Hyde, Cheshire

Illustrated is the 1960 version of the ' Sea-Esta ' Scotland airbed, a very popular model on the overseas market. The company, which is very well-known for the quality of its products for both domestic and industrial applications, has a large export market. Many thousands of tennis balls are manufactured yearly.

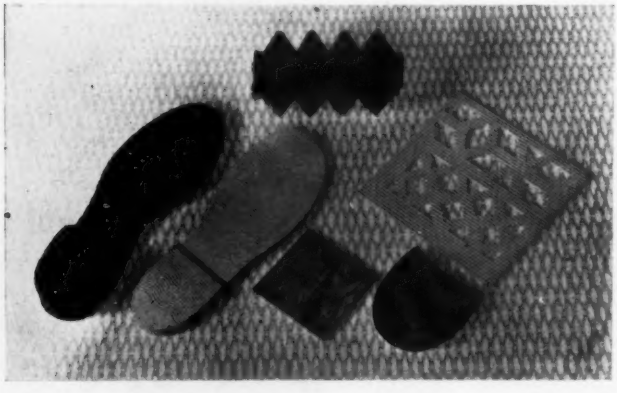
George Maclellan and Co. Ltd.
Maryhill
Glasgow

The versatility of rubber is demonstrated by the successful applicat of slush castings in the window display field. The illustration shows ' half leg ' as required by all drapery retailers selling ladies' stocking The ' girdle ' is for the exhibition of corsets in show windows and counter stands. Light weight, low breakage risk, and attractive finish should make this latest development an attractive proposition for overseas buyers, especially in view of the economical prices. The compan are leading producers of sponge playballs, latex dipped articles and compression mouldings.

The Chichester Rubber Co. Ltd.
84/86 Grays Inn Road
London, W.C.1

The production of ' Cressite ' moulded and extruded components continues to expand and many new items have been developed during the past year. A few examples from the extensive range are illustrated including a tyre, a grip, pull-on-heels, a pram handle grip, a swim-fin, a mat, a dog bone and bell mouse. Shipments to overseas markets have considerably increased and amongst recent deliveries swim-fins were sent by air to the Persian Gulf, large quantities of dog and pet accessories as well as components for the pram trade are regularly shipped overseas, especially the American market.

Cressall Tyre and Rubber Co. Ltd.
Cressite Works
Oyster Lane
Byfleet, Surrey

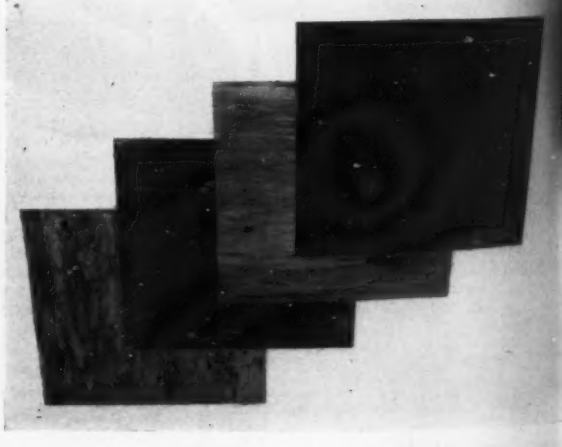


Illustrated is a small selection of the products of the company which are exported to all parts of the world. Products for the footwear industries include solid and sponge compounds for direct vulcanization process, soling sheets in natural and resin rubber, unit soles, long soles, half soles and heels and phenolic resin top-piecing. Mechanical lines include gaiters, gaskets, air bags, engine mountings, etc., and in addition they produce advertising mats, flooring and tiles in plain or marbled colours.

Perrite Ltd.
Weldbank Rubber Mills
Chorley, Lancs

The company manufactures flexible and rigid PVC compounds in a complete range of qualities and prices. These compounds are used extensively by the cable industry, general extruders, calenderers and injection moulders. Also manufactured is a commercial grade PVC film available in both sheet and tape form, in various qualities. The firm also produces the well-known ' Phenco ' flexible PVC tiles and continuous sheeting in a wide range of colours, together with PVC covings and stair nosings. Also included in this division is the manufacture of an automatic welding machine for the continuous automatic welding of ' Phenco ' or other vinyl floor coverings, together with PVC welding rods for this purpose.

Phoenix Rubber Co. Ltd.
2k Buckingham Avenue,
Trading Estate
Slough, Bucks



'Freeflex' semi-rigid and flexible containers in normal and high density polythene are manufactured by the company. The standard range of bottles covers from 2 oz. to 2 gallons, and a selection of special fitments is available for the bottles in the 2-oz. to 8-oz. range. These comprise powder plugs, straight-sprays, sidesprays, dropper plugs, and nasal sprays.

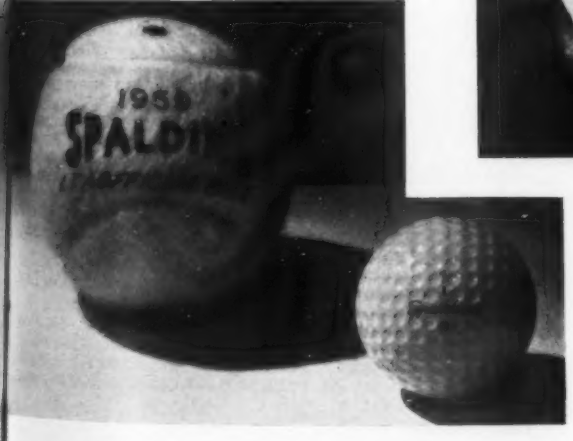
William Freeman and Co. Ltd.
Subaseal Works
Peel Street
Barnsley

The 'Pompette' shampoo spray is attractively featured in a triangular display box—in pink, white, blue and green. The 'Croydex' non-slip inside bath mat is available in pastel shades of green, blue, pink, in addition to the usual white. 'Croydex Kleenline' clothes lines for both indoor and outdoor applications feature a rayon cord centre, which will not stretch or shrink. Plastic covering is transculent in red, green, gold and clear.

New Croydon Rubber Co. Ltd.
36 Mitcham Lane
Streatham
London, S.W.16

The company manufactures a wide range of products, including rubber nursery clothing—bibs and baby pants (illustrated), bathing caps, etc. Latest additions include the 'American Miss' sanitary brief, becoming increasingly popular with British public, and the 'Vee Bolero' garment shield, designed to counteract 'woolly irritation and to provide an effective absorbent liner between the top garment and the skin.' Garments are available in a variety of sizes.

I. B. Kleinert Rubber Co.
Walpole House
91 New Bond Street
London, W.1

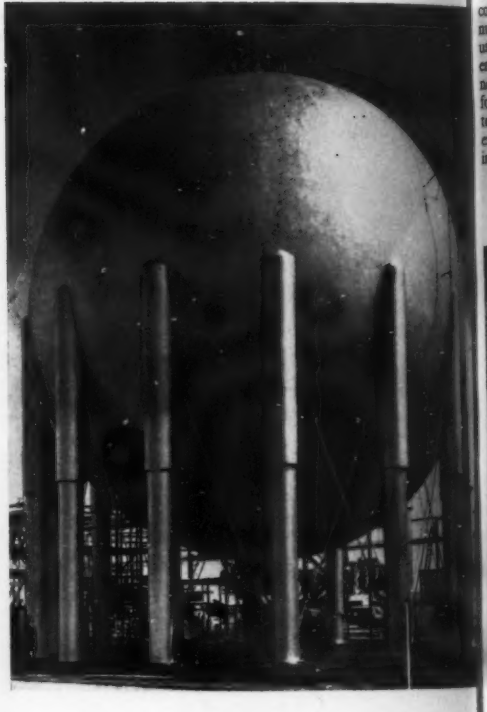


The 'DOT' is a high compression golf ball with a fluid oil centre, electrically wound with the finest activated rubber thread. A new size and depth of dimple gives a low trajectory and maximum length. The Dura-Thin (patented) cover and the longer lasting permanent white paint gives extra rounds of play. It is supreme on the greens. The Spalding LTA official tennis ball has a rubber core with an air-retaining lining and a melton cloth cover blending wool and nylon. All Spalding balls play alike, are uniform in size, weight and rebound and extra playing life is secured by the lined core and the deep nap cover. Air pressure packed tins are used for the tropics.

A. G. Spalding and Bros. Ltd.
Putney Wharf
London, S.W.15

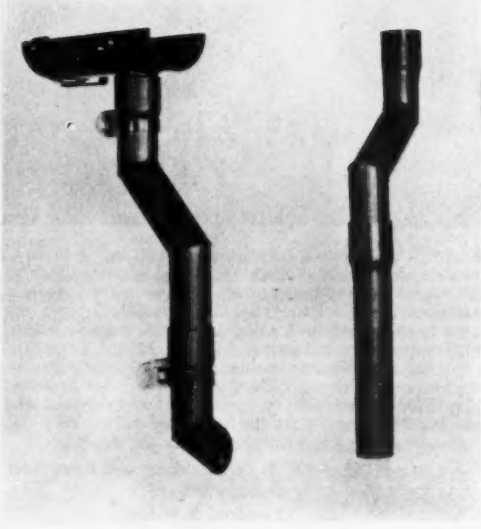
The company manufactures a wide range of synthetic resins and plastics mate-ials. These include: ' Cellobond ' adhesives and binder resins for joinery wo-chipwood, plywood and laminated beams, etc., resins for use in the manufactu- of paper and fabric laminates, and resins for the reinforcement of glass fibre a- natural and synthetic rubbers, ' Epok ' surface coating resins for the producti- of paints, etc., and ' Rockite ' moulding materials and dough moulding com- pounds. The company is sole selling agent for ' Rigidex ' polythene manufactur- by British Hydrocarbon Chemicals Ltd., and ' Styron ' polystyrene manufactur- by Distrene Ltd. The new pedal bin shown is made from ' Rigidex ' by G. and Equipment and Contracts Ltd., Gore Road, New Milton, Hants.

British Resin Products Ltd.
Devonshire House
Piccadilly, London, W.1



This 2,000-ton ammonia storage vessel is insulated with 1½-in. thick layers of ' Onazote ', an expanded ebonite with a closed cell construction. The thermal conductivity of this well-known material is extremely low—some 0.20 B.Th.U./sq. ft. hour °F. at a mean temperature of 50°F. (National Physical Laboratory figures). Moisture transmission is also very low—approximately 1.1 grams/sq. m./24 hour/2 in. at 44.72 mm. of mercury pressure. Under the same conditions expanded polystyrene (1 lb. cu. ft. density) has a transmission of 100 grams. Another of the company's products, ' Rubazote ' is used for the insulation of pipework, etc., on a smaller scale. A major application for this material is refrigeration.

Expanded Rubber Co. Ltd.
Mitcham Road
Croydon, Surrey



A complete service for the supply and erection of plastics rainwater goods is offered by the company. The range includes 4 in. and 4½ in. gutters, 2 in., 2½ in., 3 in. and 4 in. downpipes, ' LaBrec ' pipe clips and plastic-coated brackets, hopper heads, etc. The gutters and downpipes have sufficient wall thickness to take the weight of ladders and are virtually indestructible, even in the coldest weather. Specialist erection teams fit the rainwater goods with the minimum of trouble to the main contractor and in most cases, because lengths of up to 25 ft. are supplied in one piece, there are no joints to leak. ' LaBrec ' plastic rainwater goods have a minimum estimated life of 25 years, require no maintenance and cost no more than cast iron.

LaBrecque Engineering Co. Ltd.
Gaywood House
Gayfere Street
London, S.W.1

The extrusion of both simple and highly complex profiles in unplasticized and high-impact PVC, and other newly developed thermoplastic materials, represents a very high degree of specialization. The illustrations emphasize the wide scope of this class of product, each one of which is manufactured to individual specification. Equally complex profiles are also produced in numerous flexible grades of PVC. The use of extruded sections is finding a never-ending demand by industry, not only for new products and developments, but also for the replacement of conventional materials. Tubes and rods are likewise extruded in the above materials, as well as in cellulose acetate and polythene.

Melwood Thermoplastics Ltd.
Willoughby Road
Harpenden, Herts

The hot-water bottle illustrated is a new addition to the range of products manufactured by the company. Made in vinyl, its production represents something of an achievement in rotational casting. This bottle, which has good heat retention and strength, has a brass ring insert moulded into the neck to provide a firm housing for the plug-in cap. Better known for its injection mouldings, the company also manufactures a wide range of toys and novelties, hair accessories, infants' rattles, etc., and such items as soap holders.

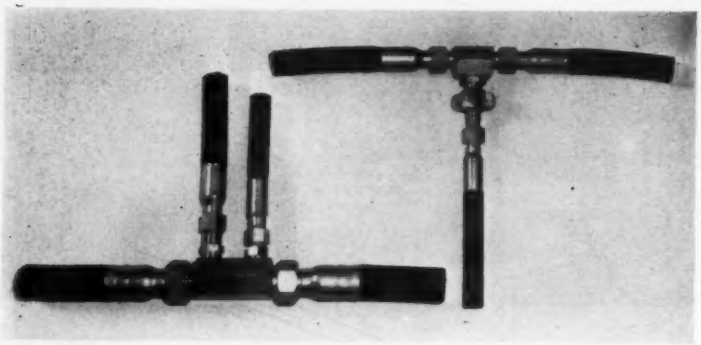
Combex Ltd.
Ganton House
Ganton Street, London, W.1

'Rilite' corrugated glass-fibre sheet, for rooflight applications, is shatterproof and can be supplied in three basic grades, translucent, semi-translucent or opaque. Materials for this application are only a small part of this company's activities. Other products include a wide range of shoes and shoe components (resin-rubber, PVC, microcellular and fibre soling), food belting, PVC for packaging applications, industrial rubber sheets, conveyor belting and sheeting for the mining industry, PVC films and laminated sheeting and a wide range of polythene, glass-fibre, and PVC products for building, flooring and decoration, etc.

Rubber Improvement Ltd.
Rilex House
Chandos Street, London, W.1

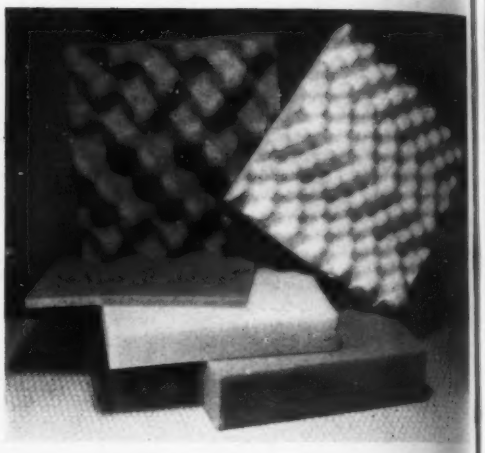
The company, which is well known for the quality of its rubber footwear, produces a range of boots, two of which are illustrated. The women's OB2 short Wellington boot is seamless and vulcanized in one piece with smooth finish. With a fleecy lining and sock and non-skid sole, this item is available in a range of attractive colours. The men's FP1 knee-length Wellington is produced on the latest equipment. It is moulded complete in one piece, together with a lining, and is of extremely rugged construction.

Futura Footwear Ltd.
River Meadow Mills
Stalybridge



The company is able to supply rubber hoses with a most varied range of pressure resistance, as well as a comprehensive variety of fittings and accessories. One field of application is in the mining industry, for which the company supplies entire sets of flexible equipment for the conveyance of water and air on all types of mechanized faces. Some sections of these assemblies are shown in the photograph on the left.

Electric Hose and Rubber Co. Ltd.
Almagam Mills
Harpenden, Herts

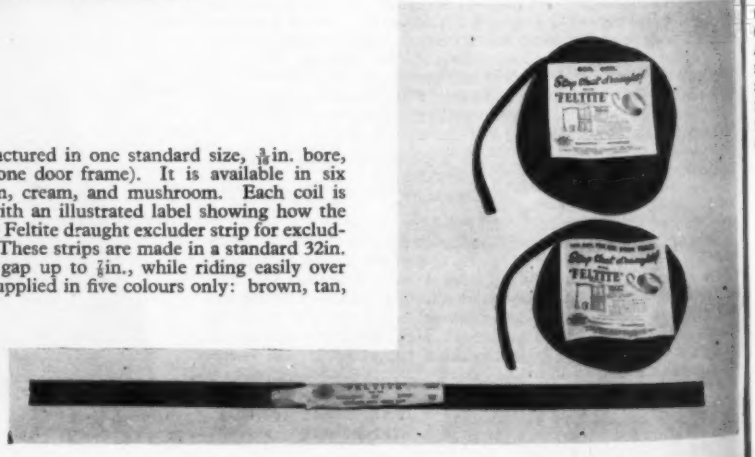


'Barafoam' is a flexible polyurethane foam available in a polyester or polyether form, with unlimited applications in the domestic and industrial fields, and possessing outstanding characteristics. Versatile, easily cut, shaped or formed with intercommunicating cell structure, it can be washed or dry-cleaned. Light in weight, resilient, and with excellent load bearing recovery and physical properties, 'Barafoam' remains hygienic under most conditions and is resistant to oils, chemicals, organic solvents, vermin and mould growths.

Plastikade (Manchester) Ltd.
Woodstock Street
Oldham, Lancs

The items illustrated here have been developed expressly by the company for export markets. They comprise a moulded rubber ice-bag and two hot-water bottles. The ice-bag can be obtained with varying surface designs; the hot-water bottles comprise a wide range of sizes and models. Those illustrated are the 'Acadia,' a size 2 bottle with a pleasing surface pattern and carrying a particularly low price ticket for export markets, and the 'Nitey-Nite' children's bottle, with a nursery scene design. The firm also manufacture fountain syringes in a variety of surface patterns.

Hytex Ltd.
304 Latimer Road
London, W.10



'Feltite' draught excluder tubing is manufactured in one standard size, $\frac{3}{16}$in. bore, in 60ft. coils, and in 16ft. coils (sufficient for one door frame). It is available in six attractive colours: Brown, tan, green, crimson, cream, and mushroom. Each coil is Cellophane wrapped, and supplied complete with an illustrated label showing how the tubing should be fixed. A companion line is the Feltite draught excluder strip for excluding draughts from along the bottom of doors. These strips are made in a standard 32in. (81.2cm.) length, and will seal effectively any gap up to $\frac{1}{4}$in., while riding easily over mats, fitted carpets, linoleum, etc. They are supplied in five colours only: brown, tan, green, cream and mushroom.

Ardray Manufacturing Co. Ltd.
96/100 Aldersgate Street
London, E.C.1

For over a century the company has maintained an international reputation for design and quality in the manufacture of rubber components and for many industrial applications. A speciality is made of the production of components for railway applications, including buffing, draw and draft gears, and vacuum brake parts. They also specialize in the manufacture of mine-car suspension and underground railway bogie suspensions which eliminate the use of laminated steel springs and guides.

George Spencer Moulton & Co. Ltd.
Bradford-on-Avon
Wilts

The company exports a varied range of extruded and moulded rubbers manufactured to clients' requirements. Standard stock lines, known under the trade name 'Britannia,' cover the motor, motor-cycle, cycle, perambulator and sports trades. The range of shaped radiator hose connexions is one of the most comprehensive and covers all popular British cars. A wide range of rubber bands is also manufactured.

The Lee-Healey Co. Ltd.
Marlow Road Mills
Marlow Road, Leicester

The company specializes in the manufacture of high quality rubber products. Illustrated is a small selection of current production, produced from five different processes. Precision rubber mouldings include 'O' rings, gaskets, grommets and intricate components plain or with metal inserts, in natural, oil-resistant synthetics and Silicone. Products include 'Beritex' meteorological balloons ranging up to 33 ft. diameter and football bladders with both nozzle and patent valve. Dipped latex products include breathing bags, masks, pressure tubing.

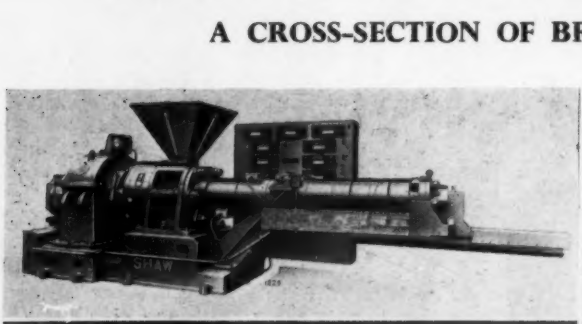
Guide Bridge Rubber Co. Ltd.
250 Western Avenue
Acton, London, W.3

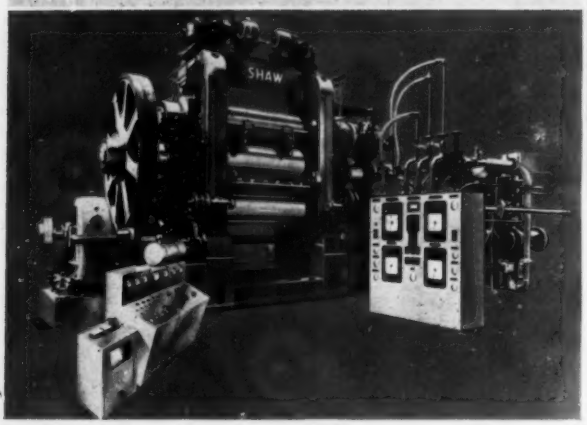
For many years the company has enjoyed a close association with the world of sport. For golfers, Avon produce not only the world-famous 'Golf Pride Grip' with its cork and rubber construction and unique design, but also 'Whitcombe Wind-on-Grips' and a range of golf ball cleaners, tees and lifters. Other Avon products which are exported to many countries overseas include table tennis sheeting, punch-ball strands, spiked batting-glove rubber, tubular grips for cricket bats and hockey sticks.

The Avon India Rubber Co. Ltd.
Sports Department
Melksham, Wilts

Rubber and Plastics Machinery

A CROSS-SECTION OF BRITISH MANUFACTURES





The company manufactures a wide range of machinery for the rubber and plastics industries. Illustrated, *above left*, is the 8-in. extruding machine, one of a series covering sizes from 1 in. to 12 in. Die heads are available for sheeting and special applications. *Left* is a 3-roll calender, one of a range of three- and four-roll machines incorporating many features of advanced design. *Above* is the company's 1½-in. extruder. One of the best known of the firm's products is the 'Intermix' series for compounding.

Francis Shaw and Co. Ltd.
Manchester 11

Illustrated is the company's 30-in. x 24-in. and 19-in. heavy-duty double-geared refining mill fitted with water-cooled bearings and incorporating a self-contained 75-h.p. drive. A large range of machinery is manufactured, including the well-known 'Monoblock' series of mills, which incorporate strength, lightness and a high degree of accuracy, and a range of calenders, of which the three-bowl even and friction speed calender for laboratory or small-scale production is of interest. This machine, which is suitable for rubber or plastics, is fitted with variable-speed drive and water-cooled bearings. A large stock of second-hand calenders, mills, extruders, presses, etc., is carried.

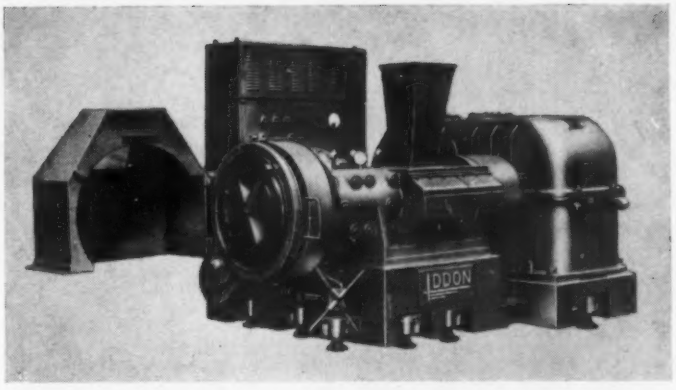
Reed Brothers (Engineering) Ltd.
Replant Works
Woolwich Industrial Estate
London, S.E.18

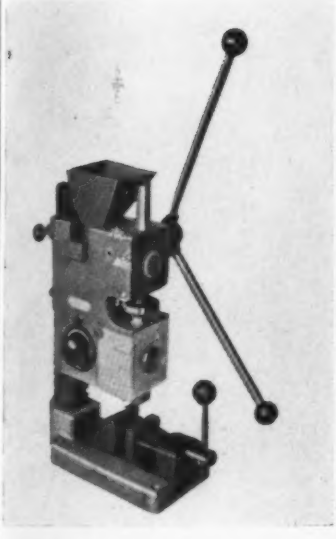
Illustrated is the company's double-geared motor-driven two-speed laboratory mill, one of a wide range which also includes the 60-in. x 22-in. motor-driven single-geared mixing mill with back shaft drive, safety guard, electro-mechanical brake and hinged and swivel guide plates for easy cleaning. Amongst presses manufactured are the 1,000-ton model and one of 600 tons. A small steam-heated two-daylight 12½/25-ton press is also included in the range.

Latex Engineering Co.
Victoria Street
Droylsden
Manchester

The heavy-duty straining machine is driven through double helical gears. It has a bayonet type locking head fitted with a rotary cutter knife and is mounted on vibro-insulators. A wide range of other units is manufactured including calenders, mixing mills, bale cutting presses, and a heavy-duty single-geared cracker with take-off conveyor. One of the latest machines in the company's range is the twin unit of 22 ft. by 60 ft. mills with central drive. An efficient technical service organization is operated.

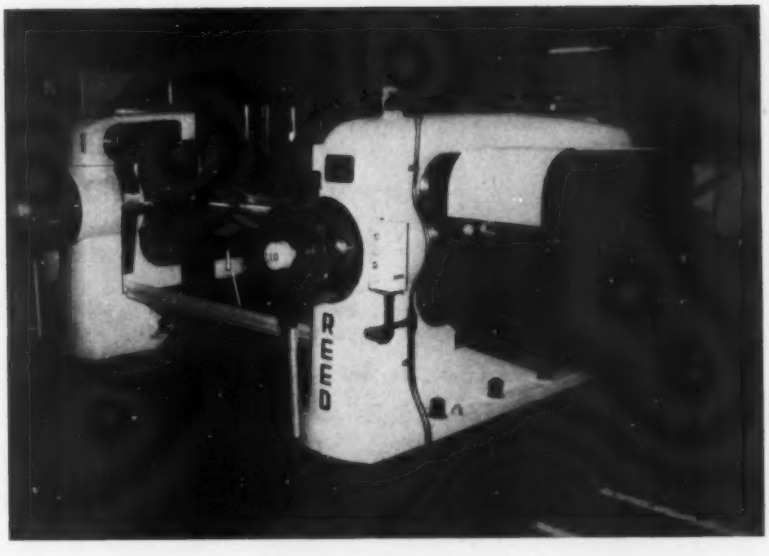
Iddon Brothers Ltd.
Leyland
Lancashire





The company are specialists in the field of small-capacity thermoplastic moulding machines for experimental work, small production runs, education and laboratory work and small component mouldings. The APM 22 hand-operated injection-moulding machine (illustrated) is of ¾ oz. capacity and has interchangeable cylinders and a selection of vices. A recent addition to the company's range is the APM 28, 1-oz. capacity machine capable of 200 shots per hour at pressures of up to 20,000 psi.

Asmiday Plastic Moulding Machines Ltd.
10 Tachbrook Street
London, S.W.1

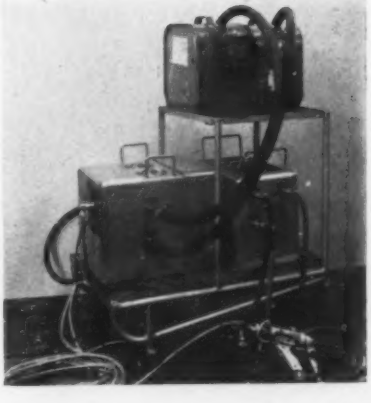


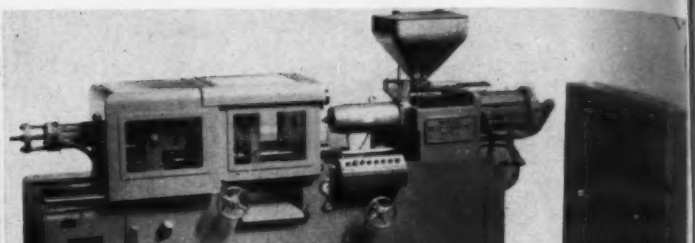
This packaging mill manufactured by the company has been well received in the UK and in export markets. It incorporates many interesting features and represents a major advance in the design of machinery of this type. A technical service department exists to deal with customers' inquiries and to advise on installation and maintenance, etc.

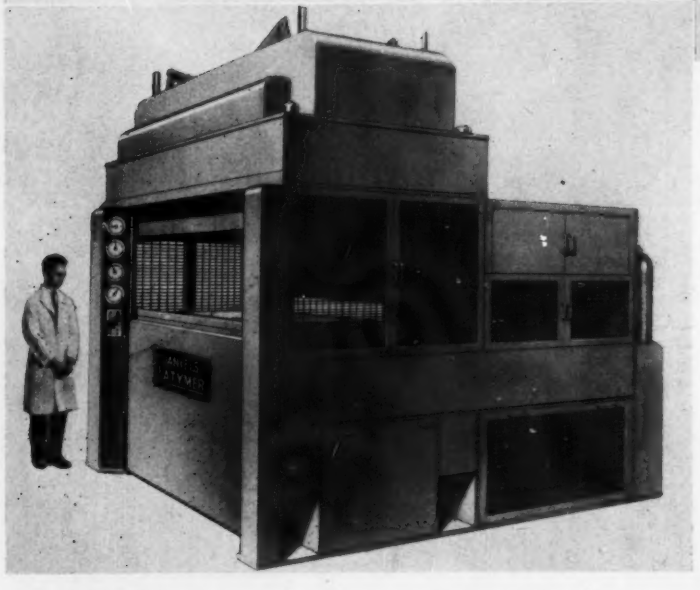
Reed Bros. (Engineering) Ltd.
Replant Works
Woolwich Industrial Estate
London, S.E.18

The illustrated machine has been developed by the company in conjunction with Imperial Chemical Industries Ltd. for the spraying of open surfaces with polyurethane insulating material. The machine sprays foam at the rate of 4¼-5¾ lb. per minute. Designed in three sections so that it can be moved easily into awkward or restricted spaces, the machine was on show at the Plastics Exhibition in London earlier this year, where it created widespread interest.

British Tufting Machinery Ltd.
Broadway Court
Westminster
London, S.W.1







Alfred Herbert Ltd., and the company for which it acts as agent, T. H. and J. Daniels Ltd., produce a variety of machinery and equipment. Alfred Herbert Ltd. produce the following units: The Edgwick 45-ton injection moulding machine, *below right;* the Herbert/Reed-Prentice 175-ton injection moulding machine, *above right;* the Herbert/Reed-Prentice 275-ton injection moulding machine; and the Edgwick mould heating and cooling unit primarily designed for moulding nylon, 'Diakon' and similar materials. The T. H. and J. Daniels range includes the 250-ton low pressure press, *above left*, the largest of a range of five; the 100-ton panel-type transfer moulding press; the 100-ton upstroke press, double or single acting; and two models of the well-known Daniels/Latymer vacuum forming machine, one of which is illustrated, *below left*.

Alfred Herbert Ltd.
P.O. Box 18
Coventry

The Boston universal take-off machine is designed to handle any profile and to give a uniform pull. With thin-walled tube or section there is no distortion and it is capable of pulling tube with a wall thickness of as little as 0.010 in. without marking. The machine has infinitely variable speeds over a wide range and can be provided with hydraulic or electronic drive. The Boston range covers all requirements from zero to 18-in. diameter. Each caterpillar is independently driven and the conveyors are separately adjustable for height. Photograph by courtesy of I.C.I. Ltd.

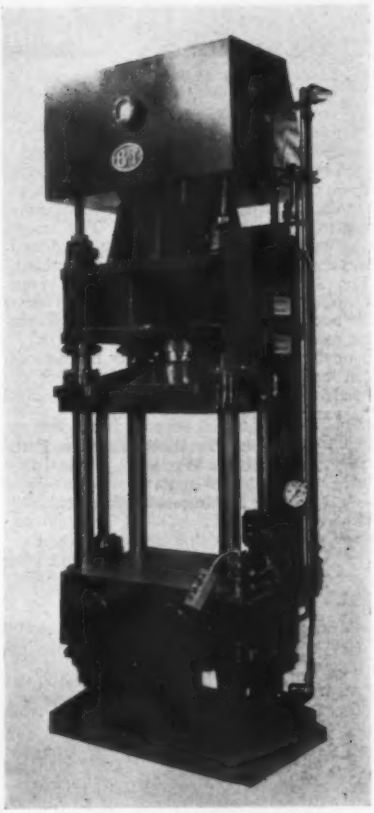
Universal Machinery and Services Ltd.
Viceroy Works
Low Fields Road
Leeds 12

The Davis-Standard 2½-in. British thermatic extruder, as shown, is the forerunner of a full range of extruders. This newly designed machine is capable of much higher speeds and output than has previously been possible. The company also manufactures all the general ancillary equipment embodying a complete extruder line for both plastics and rubber, including a vertical CV line for the rubber sheathing of heavy cables. Other products include: the range of Bolling spiral-flow intensive mixers; a 150-h.p. 2-roll mill; the continuous vulcanising machine consisting of a main roll, an upper and lower roll, a tension roll and two canvas rolls, all mounted in a fabricated steel frame with tubular cross stays; a continuous band press with hydraulically controlled pressure rolls and all steel fabricated frame; a plastic moulding press. The company is always prepared to make modifications, within reason, to meet with a customer's particular requirements.

Fawcett Preston and Co. Ltd.
Bromborough
Cheshire

The new 'Parnavac' fully automatic vacuum forming machine, model 2620, is of all steel construction and is suitable for the rapid forming of delicate cellulose acetate foil, up to heavy gauge PVC and polystyrene sheets. With a maximum forming area of 26 in. x 20 in. and a drawing depth of 0 in.-13¾ in., this machine has a working height of 38 in. The novel pneumatically operated heating hood, with a height adjustment of 0 in.-10 in., has a movement long desired in the trade. It contains the patented 'Variheter,' which is divided into three concentric zones, each independently controlled by a variable heat control, enabling complicated moulds to be formed and giving fast cycling times. The machine can be controlled by hand or the controls can be arranged by pre-selecting the process to function automatically. The compact design allows machines to be lined up in tandem, so that an operator can control a number of machines. The unit is equipped with a 1½-h.p. motor, suitable for 400/440/3/50 cycles supply.

F. J. Edwards Ltd.
359-361 Euston Road
London, N.W.1

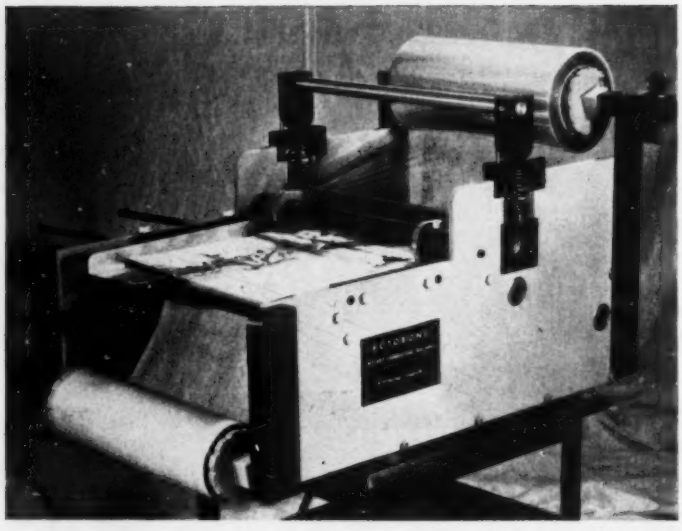


The range of moulding presses manufactured for the rubber and plastics industries includes the following: The new 5V-125 vertical injection moulding machine incorporating a screw type plasticiser and semi-automatic operation at high speeds; the 960-250 ton self-contained downstroking moulding press, illustrated, fitted with push button semi-automatic control for one or two stage cycling as used on the decorative 'overlay' process for plastics tableware and similar articles; and the 248-175 ton upstroking hydraulic moulding press fitted with five 30 in x 30 in. electrically heated platens.

Bradley and Turton Ltd.
Caldwell Works
Kidderminster

The latest Dowding Series II high speed injection moulding press is a fully automatic machine, several of which can be tended by the same operator. It has been developed especially for the rapid production of small, accurate, high quality mouldings and is designed to operate at high cycling speeds—1,200 per hour, dry—so that optimum output is obtained by fast operation with moulds having comparatively few cavities. The Standard Dowding Series II has a shot capacity of 23.6 cc. and a plasticising capacity of 20 lb. per hour. There is also a special model of 22 grammes capacity for moulding nylon. The company also make two Westminster injection moulding machines. Simple, inexpensive, but very robust, these machines have found much favour for short run, experimental and pilot production. Hand-operated injection moulding machines are also manufactured. Illustrated is the Dowding automatic fast cycling injection moulding machine.

Dowding and Doll Ltd.
346 Kensington High Street
London, W.14

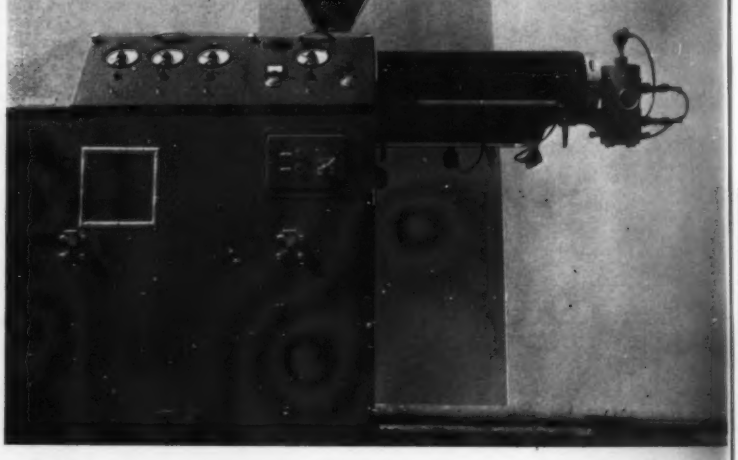


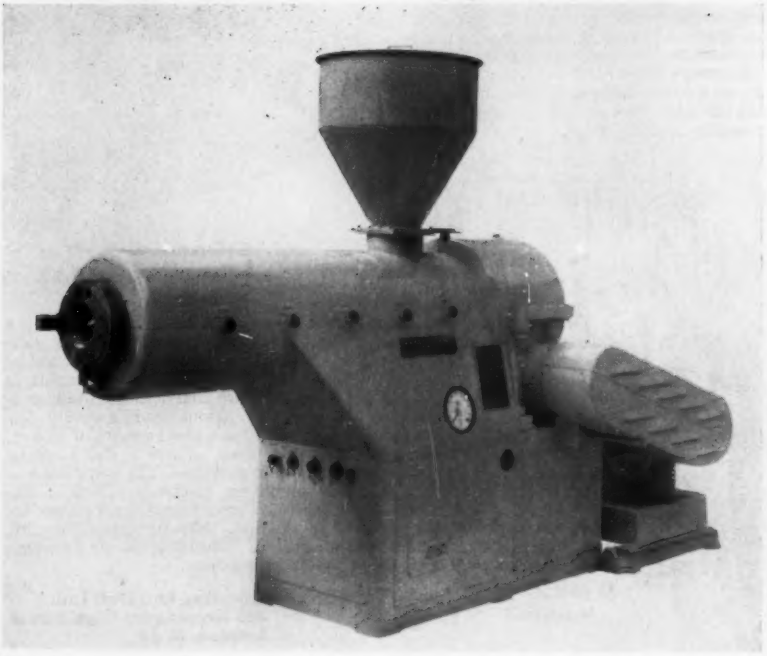
The Morane 'Rotobond' laminating machine is a low-priced equipment producing the same quality of work as large laminating machines and it is more easily adaptable to specialized work than larger and more complicated machines. The 'Rotobond' laminates on a continuous basis permitting work to be turned out at high speed and low cost. The machine employs non-inflammable, odourless adhesive and a large varity of types and gauges of films can be used on it. Difficult work such as photographs and transparencies is done without extra steps. Production speeds of up to 30 ft. per minute can be obtained and sheets or rolls may be laminated. The Rotobond is produced in 12-in., 18-in. and 24-in. maximum laminating widths. Operation is simple and needs only one person. Little maintenance is required and it is not necessary to clean after each time of using.

The Morane Plastic Co. Ltd.
21 Woodthorpe Road
Ashford
Middlesex

Extruders of 1½ in. and 2 in., fully equipped with Carter hydraulic infinitely variable speed gears, fully automatic Fielden heating units and incorporating air-pumps and cylinders within the machine for the manufacture of thin wall sleevings and tubes are manufactured. The screw and barrel liners are nitralloy hardened and the barrels themselves are water cooled. The 2-in. machine, illustrated, is being supplied with Granbull Auto-Blow units for bottle blowing as shown and is suitable for use with polythene, PVC and polypropylene, etc. The machines themselves can be supplied with different types of heads for the differing purposes for which they are required.

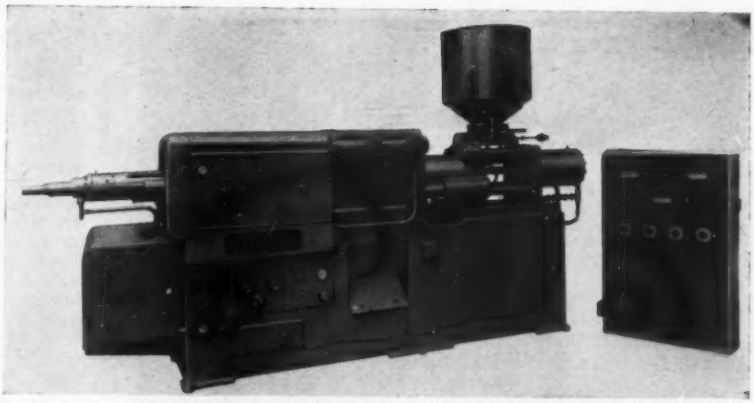
Brown, Davidson and Co. Ltd.
Banchory Works
Hartley Wintney
Near Basingstoke, Hants.





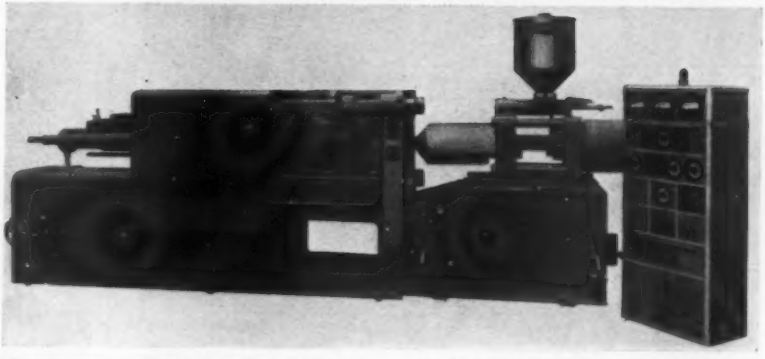
Baker Perkins Ltd., of Peterborough, England, can offer a full range of masticators and mixers for the rubber and plastics industries, extruders, injection moulding machines, vacuum forming machines, presses, cutting mills, haul off machines and mixers. A technical advisory service is at customers' disposal. For the rubber industry a range of masticators and mixers of 50, 120, and 300 lb. gravity/stock capacity is manufactured. Models 15 and 20 single-screw extruders for plastics include the latest designs with premier grade materials and ancillaries. Model 35, illustrated, is a 3½-in. extruder of the single-screw type for thermoplastics, designed to meet industry's demand for higher production than Models 15 and 20 but having the same high standard of construction. Other machinery includes the Plastmatic 30 (1 oz.) injection moulding machine, the Plastmatic 140 (5 oz.) injection moulding machine; a range of vacuum forming machines covering all types of processes; presses; the Layfield Haul-Off unit; Boston 'Senior' and 'Junior' Haul-Off machines and Dreyer Cutting Mills.

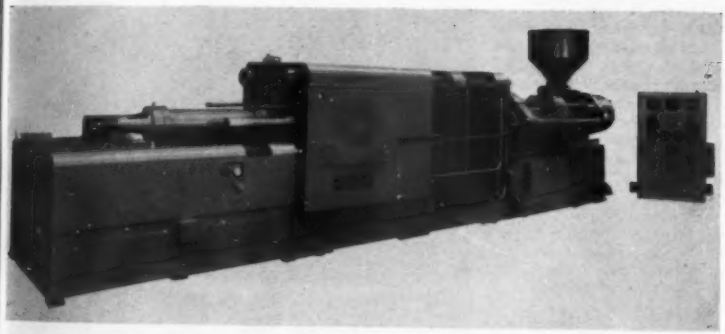
Baker Perkins Ltd.
Westwood Works
Peterborough, Northants



A comprehensive range of injection moulding machines is manufactured by the Projectile and Engineering Co. Ltd. These include the Peco Model 40MP 50 incorporating in-line pre-plasticizer, 300 tons clamping force and 24-oz. shot capacity, and an independent control system for automatic, semi-automatic or hand operation; the Peco Model 40MS40 high speed injection moulding machine with 300 tons clamping force and 12/16-oz. shot capacity, fitted with the new 'Thermax' high capacity plasticizing unit, and again with an independent control system; the Peco Model 30MS30 high speed machine with 4½/6-oz. capacity, incorporating the 'Thermax' unit; the Peco Model 12MS12 high speed automatic injection moulding machine incorporating a new die locking system, a 'Thermax' injection unit, and independent control system; and the Peco Model 50MP50 machine with the new in-line pre-plasticizer, 500 tons clamping force and 60-oz. shot capacity.

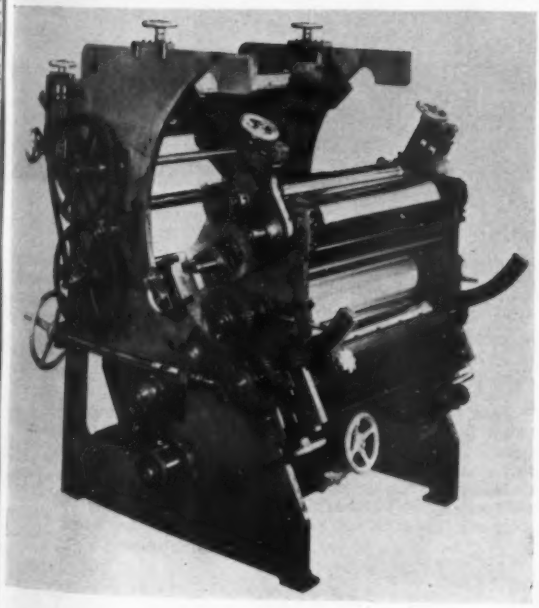
Peco Machinery Sales (Westminster) Ltd.
28 Victoria Street
London, S.W.1

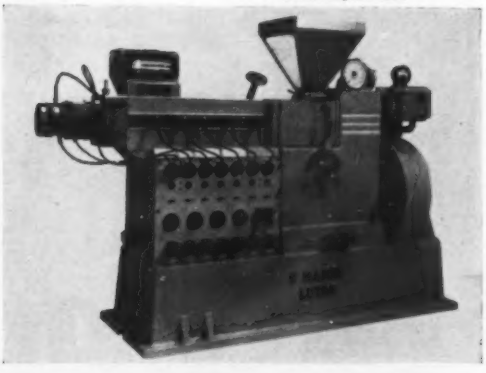




An interesting feature of the all-electric 2½-in. gate head extruding machine, illustrated, is its exceptional robust construction. Standard drive is with a BTH 15-h.p. 5/1 variable speed electric motor and gearing gives a range of screw speeds from 10 to 78 r.p.m. The control panel is fitted with Sunvic thermostats, warning lamps, plugs, switches, and fuses to control the band type heaters. A Foster 4-station temperature indicator gives temperature readings on four zones of the barrel and head. The company also produces a high efficiency 3½ in. all-electric extruder.

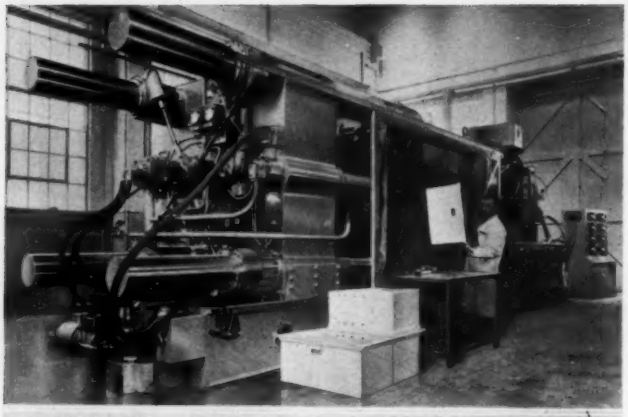
Norman Mason Ltd.
28b Guildford Street
Luton, Beds.





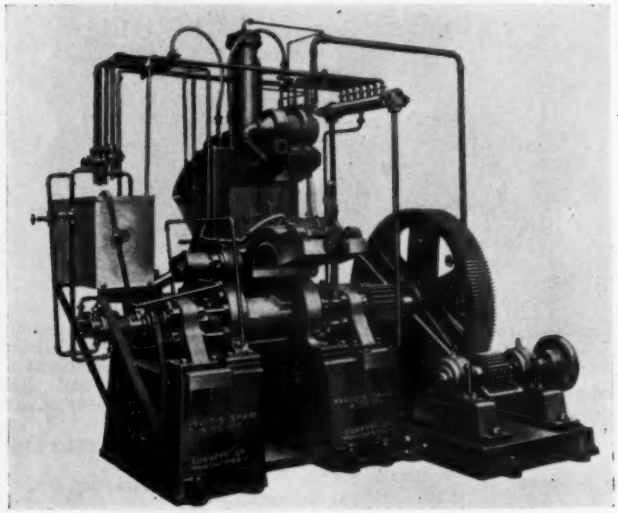
The company is offering machinery for the plastic coating of a wide range of materials by continuous process. A manufacturing agreement is held with the well-known US firm, C. A. Litzler Co. Inc. The machine shown is a four element combination coater, with elements for rotogravure, reverse roll, knife and solution coating. The company itself makes a speciality of the production of plastic coated steel strips.

Mather and Platt Ltd.
Park Works
Manchester 10



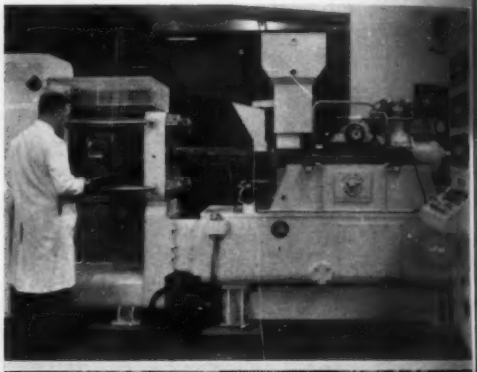
A completely new version (illustrated) of their famous Foster Wucher 700 low-pressure, injection moulding machine, which will give greater output and lower labour costs, is being produced by Foster, Yates and Thom. The machine is already notable for being able to mould shoes and shoe heels in many different thermoplastic materials at low capital cost when compared with the orthodox high-pressure injection moulding machines. The FYT range also includes two new injection moulding machines. The first (illustrated) is a three-unit hydraulic, screw-type injection moulding machine, the outstanding characteristic of which is that a preplasticizing unit has been integrated instead of being an auxiliary piece of equipment. This machine has a 100-ton clamp. The second model is a two-unit single-mould machine incorporating the same automatic injection head in which a preplasticizer is combined but with a 175-ton horizontal clamp.

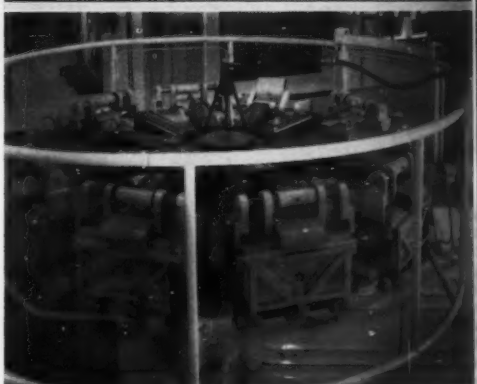
Foster, Yates and Thom Ltd.
Blackburn
Lancashire



The W 15, a 4-oz. fully automatic injection moulding machine by R. H. Windsor Ltd., is designed for general-purpose moulding. The AP 16 single-screw preplasticizer is designed to satisfy the needs of trade moulders for a machine which will give maximum colour dispersion and strain-free mouldings. The AP 20/115 machine is made for moulders who desire maximum weight shot capacity on small area articles, up to 300sq.in., and the AP 200 and AP 335 machines, equipped with two-stage preplasticizers, are designed for general-purpose moulding in the 100 to 200oz.-plus class (rated in polystyrene). These machines are suitable for the radio, refrigerator, and motor-car industries, etc. The range also includes the RC 100 twin-screw extruder, well known for its efficiency, and the 3½in. single-screw extrusion machine, a general-purpose unit for all tubes and extrusion at high output rates. Illustrated are the AP 335, *left*, and the W 15 models.

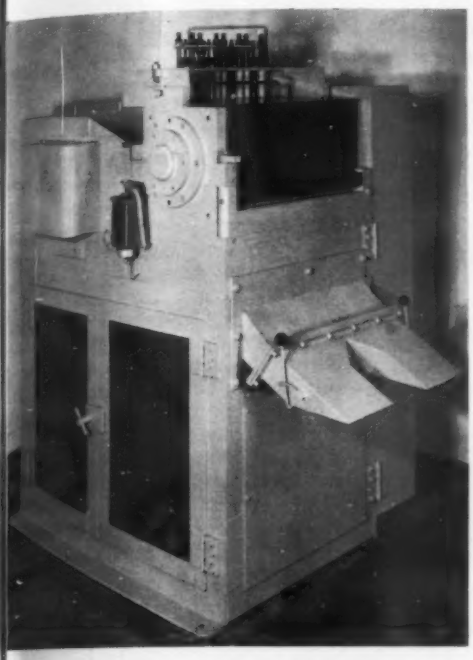
R. H. Windsor Ltd.
Leatherhead Road
Chessington, Surrey

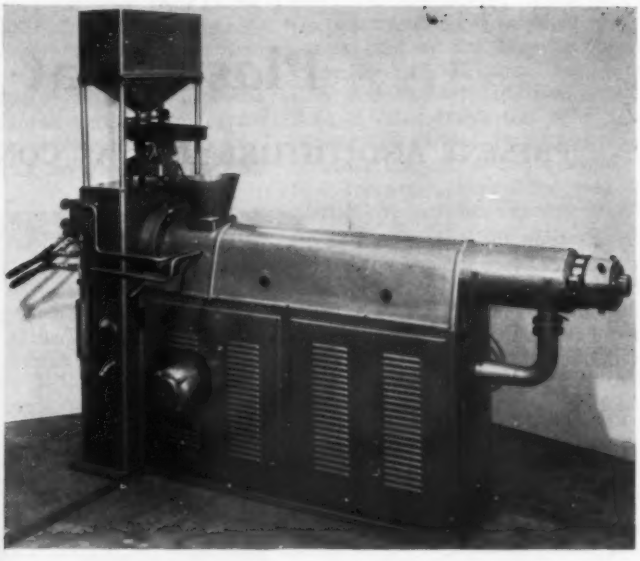




The company is a well-known manufacturer of calenders, extruders, and ancillary equipment. Illustrated is the K2 Intermix which incorporates a hinged-side mixing chamber. The approximate batch weight of this machine, one of a range of seven Intermixes, is 25lb. (S.G. 1). Other successful products of the company are the P4½in. plastics extruder, designed to produce high-impact polystyrene sheet up to 55in. wide × ¼in. thick; the P1½in. plastics extruder, with screw speed infinitely variable from 75/25 rev./min.; the SRE/180 Sturdigear reduction unit; the Shaw laboratory Rotocure; and the Shaw 'Wink' high-speed cutting machine.

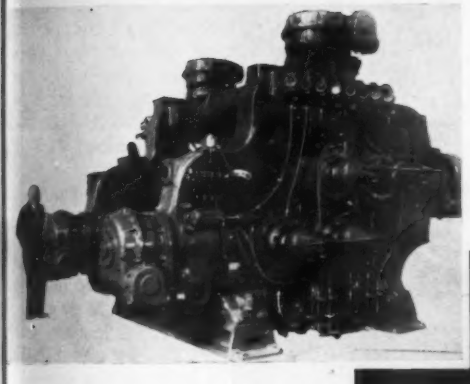
Francis Shaw and Co. Ltd.
Corbett Street
Ashton New Road
Manchester





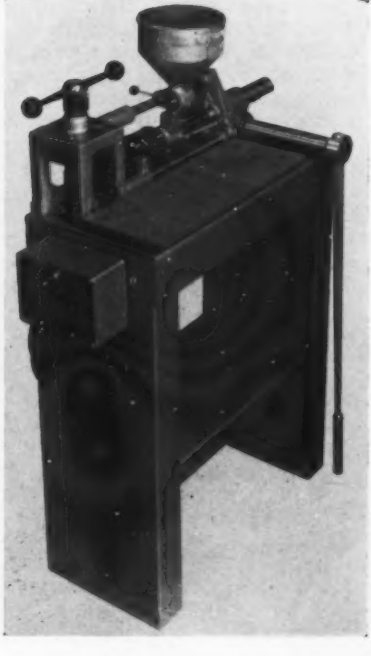
The Burtonwood Engineering Co. Ltd., in collaboration with the Cumberland Engineering Co. Inc. of Providence, Rhode Island, USA, are in production of a range of machines for granulating, dicing or cube cutting and pelletizing. The Stair-Step Dicing Machines are manufactured in four models. Two horizontal and two vertical feed. They produce perfect cubes from sheet stock in one shearing action and are capable of handling sheet stock up to 14-in. wide. Nine granulators in a power range of 2 to 100 hp are capable of handling the many different plastic materials and numerous forms in which these materials may require to be fed to the granulator. The Andouart Company, of France, have for several years been manufacturing machinery for the extrusion of rubber and plastics with particular attention to its use for cable covering. These machines are now manufactured in England by Burtonwood. Illustrated are the Burtonwood/Andouart 90 mm : 20 : 1 L/D ratio thermoplastic extruder and the Burtonwood 14½-in. horizontal feed stair-step dicer.

Burtonwood Engineering Co. Ltd.
Burtonwood
Warrington, Lancs.



A wide range of machinery for the rubber and plastics industries is manufactured by the company. Illustrated are the 28 in. x 66 in. four-roll 'Z' calender for plastics, and the size 11 high pressure high speed unidrive Banbury mixer for rubber. Amongst other products also available for export are the size 3A Banbury mixer for rubber and plastics, the well-known 12-in. extruder for plastics scrap, and the 2½-in. plastics extruder.

David Bridge and Co. Ltd.
P.O. Box 2
Castleton, Rochdale



'Manumold' unit construction injection moulding presses utilize identical basic structural elements in conjunction with a wide range of rapidly interchangeable attachments and units of differing characteristics. This ensures a high degree of both constructional and operational flexibility. Thus, the smallest manual machine can be simply and rapidly converted to full hydraulic specification at any time. The present range of units and attachments consists of two vices (one manual and one hydraulic), two manual and one hydraulic injection units, six types of plasticizing cylinders, three types of temperature controllers, two types of material hopper/dispensers, a universal mould splitter/ejector attachment, a full water cooling conversion and a universal stand. Various machine combinations are available to order but three basic models are offered as standard. The manufacturers offer a complete mould service or mould design only and provide free operational instruction.

O. Florin Ltd.
88-90 Holloway Road
London, N.7

Plastics at Work

PRESENT AND FUTURE USES AS CONSTRUCTIONAL MATERIALS

By DAVID ALEXANDER

IN assessing the present and future use for thermoplastics as constructional materials in the chemical and industrial field it is as well firstly to categorize the materials at present available, the type of structures made from these materials and the limits which at present exist in the use of plastics (Table 1). It also may be worth while to have a look at some of the new materials at present being developed and to try and assess the developments which may take place as and when they become commercially available.

Table 1

Present Materials	Present Structures	Present Limits
Opaque rigid PVC (ordinary impact)	Small self-supporting tanks	Temperature
Ordinary polythene	Limited speed fans	Mechanical strength
High density polythene	Low pressure pipelines	Comparative costs
	Low temperature pipelines	Weldability
	Fume scrubbing units (low temperature)	Range of availability
	Low temperature plating baths	Lack of British Standard Specifications and difficulties in making specifications
	Certain ducting	Maximum extrusion diameters available
		Maximum sheet sizes available

Before examining the applications for these materials it is useful firstly to compare some of their properties (see Table 2).

From this Table it can be seen that before any type of construction is undertaken an assessment must be made of the suitability of the individual material. For example the co-efficient of linear expansion of ordinary polythene is very high and therefore in circumstances where a tank is being lined in polythene and the tank is to be subjected to a considerable variation in temperature range then trouble can be expected particularly on larger tanks. In other conditions where a certain degree of vibration or movement may take place from time to time the percentage of elongation before break is very much better in polythene than PVC. Then, too, in the case of PVC the softening point comes about quickly and therefore above certain temperature limits there is no margin in using this material, whereas from the table it can be seen that in polythene there is. In many chemical plants, of course, the temperatures of processes are considerably in excess of 60° to 70°C. which is about the average working temperature maximum for PVC and polythene. In such circumstances any material which can offer a higher temperature resistance and at the same time an equivalent chemical resistance is of value. This is the case with HD polythene which can certainly operate up to 80°C. to 90°C. and in fact some claims are made for an operating temperature of above 100°C. Since the introduction commercially of high density polythene some two years ago there has been a steadily increasing use for this material in the construction of chemical plant, in many cases replacing PVC which previously has been widely used. For example, the rigid PVC fan case shown under construction; these cases are now made of high density polythene where it is necessary to allow for the operation of fan units at much higher temperatures. The method of construction, all welded, is identical to that of PVC that is of all welded construction.

A standard rigid PVC fan casing which may lend itself to manufacture from polypropylene for the handling of higher temperature corrosive gases

Table 2

	Ordinary Polythene	High Density Polythene	Rigid PVC
Softening point ..	91°C.	120° to 128°C.	70° to 80°C.
Co-efficient of linear expansion	28×10^{-5} per deg. C.	16×10^{-5} per deg. C.	7 to 8 $\times 10^{-5}$ per deg. C.
Specific heat ..	0.55 calories per deg. C. per gm.	0.59 calories per deg. C. per gm.	0.23 calories per deg. C. per gm.
Specific gravity (20°C.) ..	0.92	0.94	1.43
Tensile strength..	14,000 to 18,000 lb. per sq. in.	3,000 to 3,500 lb. per sq. in.	Approx. 8,000 lb. per sq. in.
Elongation at break	300 to 550%	300 to 800%	10 to 20%

Another important point in using plastics can be the degree of rigidity obtainable and rigid PVC is much more satisfactory than polythene from this point of view. The illustration of a 20in. duct under construction shows that ¼in. thick PVC is entirely satisfactory for this purpose but if polythene were used $\frac{3}{16}$in. to ¼in. material would be necessary. As an alternative to this material, HD polythene can be used but at present the price differential is too great to allow its use except where the temperature is sufficiently high to forbid the use of PVC. Also the forming and welding of high density polythene takes longer and therefore puts up end costs compared with PVC. At present a number of companies are developing new techniques in the forming and welding of high density polythene which may well result in a reduction in the labour costs to very nearly the equivalent to PVC. If the raw material price for HD polythene also drops then no doubt the material will be used more widely for lower temperature work than it is at present.

Standard rigid PVC ducting being made from foreign sheet

In the last two years particularly, much of the prejudice which existed against the use of plastics is disappearing, probably as a result of technical information that is now more readily available in the Press and due to a considerable improvement in the quality of the materials available, particularly in the case of PVC. In most cases today when faults arise where plastics are used, these can be traced to constructional defects or the selection of the wrong material for the job. Very seldom is it a basic manufacturing fault in the material itself. As is known this certainly was not the case some five years ago when such difficulties as de-lamination of sheet, cold inclusion in extrusions and considerable degrees of plasticizer caused much difficulty.

The plating industry, for example, is now one of the biggest users of plastic fume extraction ducting and hoods and in practically all new installation undertakings the use of these materials is almost certain in departments of the plating works where temperature is not a problem. Companies such as the English Electric Company Ltd., Ericsons' Telephones Ltd., and Mullard Ltd. have installations of considerable size in PVC in plating and similar departments.

In the last year or two a number of new companies have come into the plastics engineering industry and as a result of this there has been an overall reduction in prices for installation. While this is a good thing there have been some instances where price cutting has resulted in inferior workmanship. There is no doubt a case for the creation of some British Standards for chemical plant or at least the sheet tube and welding techniques and for a publicity campaign to educate the user in the value of these standards. However, in spite of the slight reduction in the cost of plant constructed from plastics the overall price structures are still too high to allow a very large expansion of the use of these materials in fields where metal ducting is used at present.

There are technical advantages in many instances to the use of plastics ducting for ordinary ventilation purposes but there is not a case for the use of this material at two, three and four times the price of galvanized steel ducting. Two main factors probably contribute principally to this price differential. These are the basic cost of the raw material and the technique for constructing plant and ducting from these materials. Whilst

A typical plating installation of three PVC fume hoods, PVC ducting and extractor fans which replaced a coated metal system. (*Photo courtesy Plastics Constructions (London) Ltd.*)

the plastic engineer cannot do much about reducing the price of the raw material it may well be that by the development of new techniques for welding or joining plastics a considerable reduction in finished plant prices can take place. Already in Germany experiments in new techniques are taking place and it is hoped that further information can be given in this series after the coming Dusseldorf Exhibition in October.

Even with the present materials, polythene, HD polythene and PVC there is a considerable undeveloped market, based on present price structures in the UK, and it is only by continuous publicity through advertising, technical journals and individual contacts by plastics engineering companies that such developments can take place. For example many times the question must have been asked—well, how long does this stuff last? and the answer to this type of question is important. A very interesting list was published in *Modern Plastics Encyclopaedia of 1956* which gave the figures quoted in Table 3.

A PVC lined steel fan of dimensions which may well prove suitable for polypropylene

Table 3

Installation	Environment	Years of Satisfactory Service
2½-in. pipeline	Conc. HCl outdoors	18
4-in. piping, 500 ft.	Conc. HCl, 140°F., outdoors	11
Storage tank	15% H_2SO_4	14
Exhaust and duct system	H_2SO_4 fumes, 160°F.	3½
Pickling storage	HNO_3, H_2SO_4, HF	14
Tank 10 ft. high	Fuming HNO_3	6
Exhaust system	Aqua regia	3
Chlorination column, 12 ft.	Wet chlorine	3
Reaction vessel	Chlorine dioxide	3
Etching system	HF	2½
Piping	Vinegar	11

Possible Future Trends

Apart from any future developments which may take place in the thermoplastics materials at present available there are fortunately in various stages of development newer thermoplastics which may well provide some of the answers to the limits of the existing materials particularly with regard to temperature and mechanical strength. Four new main materials, which are already, to some degree, commercially available are high impact PVC, polypropylene, polycarbonate and clear rigid chemical grade PVC.

In the case of clear rigid chemical grade PVC the big requirement is clarity without any sacrifice of the chemical properties of ordinary PVC. As yet it has not been possible to obtain any real information on the material after it has been in use, certainly in the UK. However, in France and other parts of the Continent a chemical grade has been developed for which it is claimed that none of the properties of opaque rigid PVC have been sacrificed. If this is the case then it is only logical to expect that in the not too distant future the material will be available over here.

Similarly there is little real practical information on the polycarbonates in the UK but it is known that chemical plant has been made and installed with success both in the US and Italy.

High impact PVC is now becoming available in the UK and installations have been carried out using British Geon material. If the claims made that the impact strength is up to 15 times that of ordinary PVC prove accurate then there must be a considerable outlet, although apparently in order to obtain this impact strength a slight sacrifice has been made with regard to both temperature and chemical resistance. A report on high impact PVC was given in a recent issue of *RJIP*.

Polypropylene

Polypropylene is the most recent development of the polyolefin range which began with ordinary polythene and was extended to the high density materials. There are basically two types, the isotactic and the atactic. According to the proportion of these two types in the material so the final structure can be affected giving varied degrees of stiffness in the product.

This material is thermoplastic and is free of colour and odour and at the same time maintains rigidity and has very good tensile properties at much higher temperatures than those of the other range of polyolefins such as ordinary polythene and HD polythene. Also the specific gravity is only 0.90. Another interesting feature of the material is that it has a much better dimensional stability at high temperatures and is much more resistant to creep than the other two materials mentioned. Table 4 shows typical properties.

As a matter of interest polypropylene is dimensionally stable up to temperatures of 150°C. when the article is not subjected to outside stresses and this compares very favourably with polymethylmethacrylate, PVC and polystyrene which show deformation round the 100°C. point. It has been said that polypropylene loses many of its properties at lower temperature ranges but to a considerable extent this must depend on the type of structure of the polypropylene and also the type of impact load to which the

material is subjected. For example, above 40°C. polypropylene is practically unbreakable whereas at −10°C. polypropylene still has an impact resistance which is as good if not greater than PVC. Another point is that the orientation of the crystals in the structure play an important part in the effect. For example if the impact load is parallel to the direction of the flow of the material then it has an excellent impact resistance even at −70°C. The important point here is that it all depends on the method of production of the end product and the type of polypropylene used.

The great outlet for this material in the plastics engineering industry will be in the construction of plant to handle, for example, 80% sulphuric acid or concentrated hydrochloric acid up to 100°C. where such materials as PVC and polythene cannot be used.

Ageing

On the question of ageing it may not be possible to give as yet much information but it would seem that in the natural material the effect of ultra-violet light will be the same as with ordinary polythene and can be avoided, therefore, by the inclusion of a small percentage of carbon black. Such inclusion, however, would mean that the considerable degree of clarity that is available in the natural material would be lost.

Due to its various properties, this new material will be of very great interest to the plastics engineering industry particularly as the material is suitable for welding using the same techniques as applied to ordinary polythene, PVC and HD polythene. Also the material can be used for extrusion purposes and also for the forming of sheets, this means, at its lowest conservative level, that a 50% increase in the temperature for chemical plant made from plastics will become available and from various indications it would seem that even higher temperatures can be envisaged before long.

In practice this is of considerable importance. For instance, the large fan illustrated is at present made from a mild steel outer casing with a rigid PVC lining fitted inside. The impeller is made entirely from rigid PVC and is of welded construction. By the use of polypropylene the metal outer case should no longer be necessary as the polypropylene will have the strength in itself for this size of structure also with an impeller made from this material it may be possible to operate the fan at faster speeds thereby giving more efficient units and of course at the same time allowing these fans to operate within a new temperature range. Another illustration is of a specialized processing cabinet the base of which has had to be stiffened with polythene coated steel angle section. Structures such as these made from polypropylene may well eliminate entirely the use of steel as a strengthening agent. Many similar applications such as these where strength is of importance and where at present this strength is obtained by the use of coated metals, will be possible using polypropylene and perhaps in the future polycarbonates for such purposes.

It is not easy to forecast the new fields in which plastics may be seen at work but apart from the chemical industry which is a certain outlet for the materials it would seem that the building trade holds perhaps the biggest potential outlet. Already downpipes and guttering in PVC are being produced, cold water polythene piping is and has been available for a long time and very shortly perhaps polypropylene may provide the answer for hot water in domestic installations. In the near future rigid PVC window frames are coming on to the market and there are the first signs that the detachable double window frame is coming on to the domestic market *(RJIP* August 29 1959).

Electrical conduit in PVC is at present used for specialized applications but it would seem almost certain that the use of this material for domestic installations will be considered before long especially when the price structures can be reduced. Already in use is ducting for ordinary ventilation purposes on ships, this material is usually again PVC but until such time as the price has been considerably reduced the applications in this field must remain limited.

It is possible to look at almost any industry and see outlets for plastics and there must be as many more which as yet we cannot envisage.

Table 4

Property	Test Method	Units	
Specific gravity	ASTM D 792—50	g./cm.^{3}	0.90—0.91
Bulk density	ASTM D 1182—54	g./cm.^{3}	0.40—0.50
Yield stress	BS 903/1950	lb/sq. in.	4,000—5,200
	4 in.min.	kg./sq. cm.	270—350
Ultimate stress	,,	lb./sq. in.	4,000—5,200
	,,	kg./sq. cm.	270—350
Elongation at yield	,,	%	10—25
Ultimate elongation	,,	%	400—900
Flexural modulus	ASTM D 747—50	lb./sq. in.	130—170 × 10^3
		kg./sq. cm.	9—12 × 10^3
Impact strength (Izod)	BS 903/1950	ft. lb./in. notch	2.5—4.0
		kg. cm./cm.^{2}	10—16
Hardness	Rockwell ASTM D 785—51	R. Scale	85—100
Vicat softening point	DIN 57302	°C.	150
Softening temperature			
30° deflection	BS 1493/1948	°C.	138
60° deflection	,,	°C.	150
Specific heat (solid)	20°—60°C.	Cal./g./°C.	0.46
Thermal conductivity (solid)		K cal./cm./cm.^{2}/sec./°C.	3.3 × 10^{-7}
Coeff. of linear expansion		cm./cm./°C.	110 × 10^{-6}
Mould shrinkage	ASTM D 955—51	%	1.0—2.5
Volume resistivity	ASTM D 257—54 T	ohms/cm.	0.7—1.0 × 10^{16}
Dielectric constant 10^6 c.p.s.	ASTM D 150—54 T		2.0—2.15
Power factor 10^6 c.p.s.	,,		2.3 × 10^{-4}

(By courtesy of Shell Chemicals Ltd.)

This processing cupboard shows where plastic-coated steel angle section is used to give strength. In structures such as this made from polypropylene the use of steel may be eliminated

Rubber Bearings for Bridges

DESIGN CONSIDERATIONS

By A. N. GENT

BRIDGES are not completely stationary. The deck of large bridges may vary in length by an inch or more due to temperature changes, while modern design leads to relatively flexible structures which bend appreciably under load. These movements should not be imposed on the bridge supports — indeed, they may be unable to withstand them—and some form of flexible intermediary is necessary. In the past rocker or roller arrangements, or sliding plates, have been used to allow the bridge to move or rotate without imposing large stresses on the supporting piers. However, if wear or corrosion takes place, these conventional bearings may be seriously impaired and create abnormally large stresses in the bridge and its supports. Interest has therefore been shown in the use of rubber units as bridge bearings—to carry the weight of the bridge and superimposed loads, while allowing movements due to temperature and load fluctuations to take place.

This use is comparatively new, although rubber pads of various types have been widely employed in civil engineering structures, including bridges, as load-spreading members. The first application of rubber bearings in bridges appears to have been in France[1], where simple rubber blocks, restrained by interposing wire grids or perforated metal plates, were employed. In this country it was first suggested by the firm of consulting engineers, W. S. Atkins and Partners, in considering the design of bridge bearings in 1955. They proposed a rubber-to-metal bonded sandwich structure to give well-defined compression and shear characteristics. In collaboration with the Andre Rubber Company and the British Rubber Producers' Research Association, a satisfactory design was evolved, and employed in the Pelham bridge at Lincoln[2], which was opened by H.M. The Queen in June 1958. Since it is a major application, the design of the rubber bearings is treated in some detail below. Similar bearings have been accepted for about forty bridges since that date, including the London Midland Region main line railway bridge over the Manchester-Stockport road[3] and the Wellesley road bridge forming part of the Chiswick fly-over[4], while another type of bearing (the Freyssi pad) has been employed in the Hook underpass bridges[5].

THE AUTHOR

ALAN N. GENT, Ph.D., A.Inst.P., A.I.R.I., was educated at the City Boys' School, the College of Technology and University College, Leicester. He was employed by the John Bull Rubber Co. Ltd., and after military service joined the British Rubber Producers' Research Association in 1949 *as a research physicist. He has studied the mechanical behaviour of rubber under large elastic deformations, under vibratory forces and under extreme temperature conditions; the results have been published in numerous papers. He is now a Principal Physicist and, in addition to research work, leads a technical advisory section concerned with new engineering uses of rubber.*

Design Considerations

To prevent appreciable changes in height under changing load conditions the bearings must be stiff in a vertical sense and support the total load of the bridge, superstructure, and traffic without a large vertical deflection. The Pelham Bridge bearings, for example, were required to deflect not more than ¼in. under the maximum vertical load of 130 tons.

In a horizontal sense, the bearings must be sufficiently soft that a deflection of an inch or so does not impose intolerably high stresses on the supporting piers. They must, however, be stiff enough to prevent excessive lateral movements of the bridge under, for example, wind loads and the effects of traffic acceleration and braking. These requirements indicated a horizontal stiffness of about 10 tons per inch for the Pelham Bridge bearings.

The vertical stiffness was thus required to be more than 50 times greater than the horizontal stiffness. Ratios of this order may be readily obtained with thin bonded rubber blocks, since the shear stiffness is inversely proportional to the thickness, while the stiffness in compression is inversely proportional to the third power of the thickness, to a first approximation.

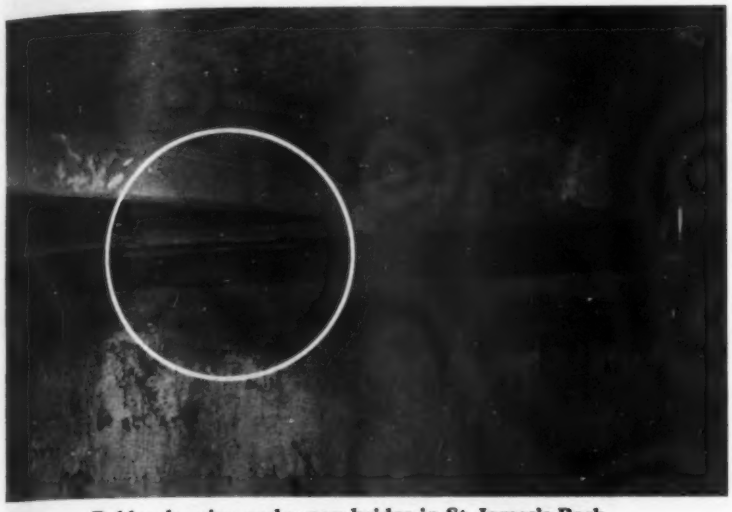
The Andre Rubber Company designed bonded blocks 24in. long by 16in. wide, and about ¾in. in height, to give a ratio of compressive stiffness to shear stiffness of about 100:1. To give the required shear stiffness of about 10 tons per inch, five of these units were assembled in a composite bearing, the corresponding overall compressive stiffness being about 1,000 tons per inch. The entire unit was surrounded by a layer of rubber ¼in. thick to protect the metal interleaves from corrosion and to provide a bedding surface for the bridge and pier. Two bearings are shown in the figure under a compressive load of 200 tons, the location of the internal plates being revealed by the slight surface corrugations under load.

Stiffness Calculations

The shear stiffness R_s for moderate shear deformations of thin blocks is given by $R_s = AG/h$,
where A and h are the cross-sectional area and thickness of the block, and G is the shear modulus of the rubber. The compressive stiffness R_c for small compressions depends upon the *shape* of the block; for blocks of circular and square cross-section (and also rectangular section when the sides are not widely different in length) it is given approximately by[6]

$$R_c = AE_o\,(1 + 2ks^2)/h,$$

where E_o is Young's modulus for the rubber and k is a numerical constant taking the theoretical value of



Rubber bearing under new bridge in St. James's Park

unity for soft rubbers. The quantity s is the ratio of the area of one bonded face to the force-free area of the block, given, for example, by 1/4h for a square-sectioned block of side l and thickness h. It has been termed the 'shape factor.'

The relation between Eo, G, k and the BS indentation hardness of the rubber is given in Table 1.

TABLE 1
ELASTIC CONSTANTS

B.S. hardness (degrees)	*Young's modulus E_o (p.s.i.)*	*Shear modulus G (p.s.i.)*	*k*
40	210	65	0.95
50	340	90	0.75
60	540	140	0.60
70	850	210	0.55
80	1,500	410	0.52

For rectangularly-sectioned blocks, having one side much greater than the other the compressive stiffness is [6]

$$R_c = wE_o \left(\frac{4}{3} + \frac{4}{3} ks^2 \right) / h,$$

per unit length of the bearing, where w is the width of the bearing and the shape factor s is given by w/2h.

The tilting stiffness for such a bearing when one bonded plate is rotated about its long axis, is given by [7]

$$R_t = w^3 E_o (1 + ks^2/5)/9h,$$

per unit length of the bearing. A corresponding relation cannot readily be derived for other bearing sections.

The rubber employed in the Pelham bridge bearings had a B.S. hardness of about 70°, corresponding to values of Young's modulus and shear modulus of about 850 psi and 205 psi, respectively. From the bearing dimensions, the shear and compressive stiffnesses are calculated to be 8.0 and 1,400 tons per inch, in reasonably good agreement with the measured stiffnesses of 9.4 and 1,200 tons per inch.

Maximum Stresses

Failure of a thin bonded block in compression occurs at the edges of the bonded plates, when the shear stress at these points exceeds the bond strength. The mean compressive stress P_c applied to the block is related to the shear stress P_s developed at the bonded edges by [7],

$$P_c = \frac{2}{3} s P_s$$

to a first approximation, where s is the shape factor of the block.

When the shear stress P_s is made equal to the bond strength, the corresponding value of P_c is that causing incipient failure. Obviously no general value can be given for this, since it depends directly upon the shape factor s also. If a figure of 500 psi is taken as the maximum permissible shear (bond) stress, then the maximum permissible compressive stress for the Pelham bearings, where s=6.5, is about 1 ton per square inch. At larger shape factors correspondingly larger compressive stresses could be imposed.

When a shear displacement is applied to the block simultaneously, an additional shear stress will be imposed on the bonded faces and allowance must be made for this in calculating the permissible compressive stress. It is generally a small fraction of the breaking stress P_s, however, and hence may not materially affect the calculations.

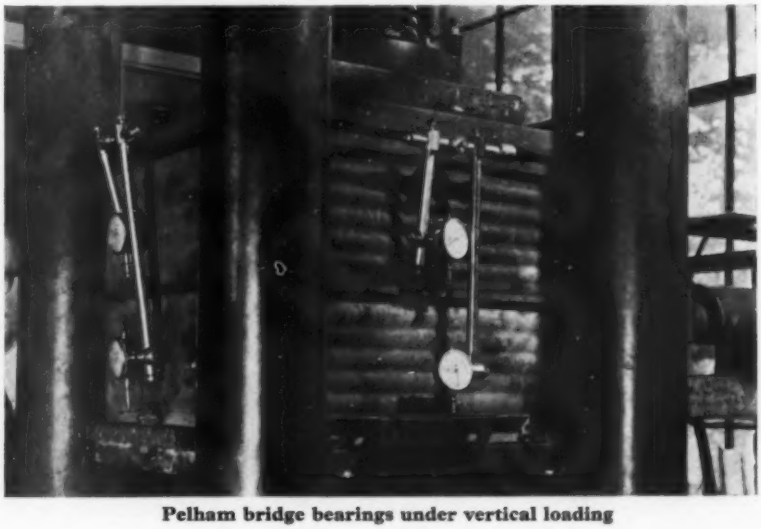
The central region of thin bonded blocks is subject to a hydrostatic pressure on compression. The corresponding contraction in volume is generally too small to affect the calculated stiffness appreciably, and may usually be neglected[7]. However, when the block is subjected to a *tensile* stress, the rubber in the interior is subjected to a hydrostatic tension and undergoes internal rupture at a mean tensile stress P_t, given approximately by [8]

$$P_t = 0.4\, E_o$$

It is important, therefore, that any applied tensile stress should not attain this value.

Stability Considerations

Large thin blocks of rubber seem obviously stable in simple compression. However, an apparent instability may occur, due to the very different stiffness in shear and compression, if the compressive load is not applied exactly at right angles to the bonded surface. If the departure is 0.5°, for example, then about 1% of the compressive load acts to shear the bearing. Since the shear stiffness is low, possibly only one-thousandth of



Pelham bridge bearings under vertical loading

that in compression, a relatively large shear displacement may occur. It seems necessary, therefore, to arrange that the bearings are accurately horizontal initially, and that the supports do not yield non-uniformly.

Life

The compressive load acts as a substantially constant one, while the maximum shear movements are only imposed annually with seasonal temperature changes. Hence, fatigue due to cyclic deformation may be disregarded. The compressive deflection will gradually increase with time, and this may ultimately mark the end of the useful life; *i.e.* settling of the bridge will become unacceptably large eventually, or the reduced thickness of the bearings will affect the shear stiffness to an unacceptable degree.

The settling over long periods is primarily due to oxidative attack, and this is notoriously difficult to assess by accelerated tests. However, the size of the unit itself affords some protection by limiting access of atmospheric oxygen to the bulk of the rubber, while the bearings are generally shielded from direct sunlight and do not encounter high temperatures. Natural rubber units, suitably compounded to resist weathering and long-term oxidative attack, appear to be fully satisfactory and a life of some decades may be anticipated.

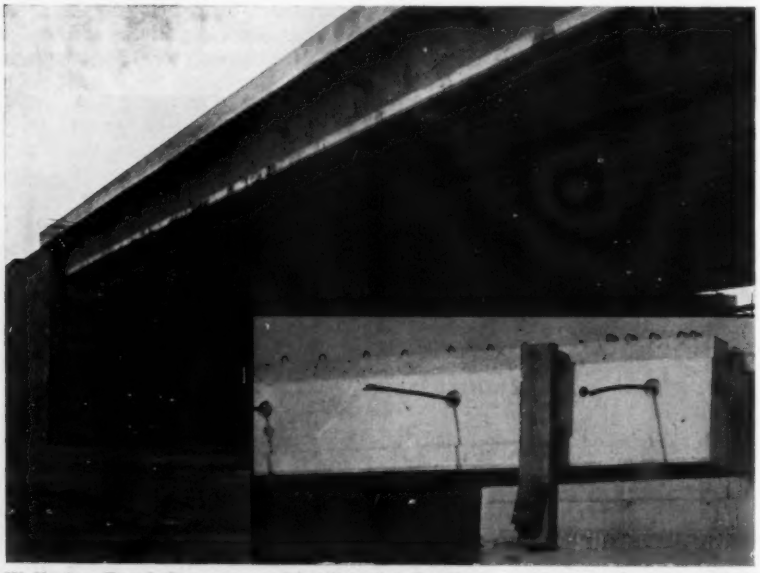
Discussion

Rubber bearings differ in principle from conventional types. Whereas a sliding system does not allow movement at all until the frictional forces are exceeded, and then moves freely through large distances, a rubber spring bearing restricts movement with a force proportional to the displacement, so that small movements meet with light resistance and large ones create correspondingly greater reactions. It is not easy, therefore, to compare rubber bearings directly with conventional ones. However, the maximum resistance developed in the Pelham bearing under the maximum shear displacement is similar to the frictional force required for any motion to occur in well-maintained conventional bearings under the same vertical load[9].

Rubber bearings therefore seem to be at least as efficient as conventional ones, while they should require less attention. Complex arrangements of roller or rocker bearings may also be replaced by simple rubber bearings, since the stiffness in different directions may be varied by the use of flat, inclined, or domed bonded plates (giving low stiffnesses in two directions, one direction, and in rotation only, respectively).

The use of rubber springs as bridge bearings seems to have considerable potential, and other uses are already developing in allied fields. It is hoped that the present account is of general interest, therefore. Further information is readily available from the manufacturers, the Natural Rubber Development Board and the Research Associations.

Rubber bearings (*arrowed*) **in the reconstructed railway bridge over Stockport Road, Manchester** (*British Transport Commission photograph*)



Wellesley Road flyover on the Chiswick by-pass. *Inset*—**Location of bridge bearings**

Acknowledgments

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A Year in Review

A CALENDAR FOR THE RUBBER AND PLASTICS INDUSTRIES FROM DECEMBER 1958—SEPTEMBER 1959

DECEMBER

Home

THE inaugural Christmas Lecture of the Institution of the Rubber Industry was held in Liverpool on December 16, when Mr E. F. Powell gave an illustrated lecture on 'Science in the Rubber Industry.' The Annual Dinner of the Institution was held in Manchester on December 17, and was marked by the presentation, by the president, Sir John Dean, of the Colwyn Medal to Dr J. Le Bras, and the Hancock Medal to Mr H. Willshaw.

The petrochemicals plant at the Fawley refinery of the Esso Petroleum Co. was officially opened by the Minister of Power on December 5. The plant will produce ethylene at the rate of 40,000 tons/year, and butadiene at the rate of 42,000 tons/year, the whole project costing about £10m.

The National Boat Show, which opened in London on December 31, featured a number of interesting rubber and plastics products, among which were glass-fibre reinforced boat hulls.

A new Dunlop ciné-film 'The Care and Maintenance of Conveyor Belting,' was introduced during the month.

In a November decision, reported during December, the Court of Appeal decided that the makers of a hot-water bottle which split and scalded the user after three months' service were liable to pay the damages of £75 awarded by the County Court Judge.

A joint committee was set up by the Institute of Welding, the Plastics Institute, and the British Plastics Federation to consider the technological needs of industry as regards the welding of thermoplastic materials.

Overseas

Figures relating to Russian rubber consumption showed imports of natural rubber during 1958 to be 140,700 tons, compared with 35,000 tons during 1955, and with synthetic rubber imports of 26,100 tons in 1956. Production of synthetic rubber in the Communist bloc was scheduled to be at the rate of about 1,000,000 tons/year by the end of 1960, comprising Russia 760,000 tons, East Germany 100,000 tons, Poland and Rumania 50,000 tons each.

A contract to export 8,000 tons of synthetic rubber from Italy to Russia in exchange for crude oil was announced.

In America the Rubber and Plastics Division of the American Society of Mechanical Engineers met in New York to hear a wide variety of papers in three technical sessions. The Seventh Annual Wire and Cable Symposium was held from December 2–4 at Astbury Park, N.J., under the auspices of the US Army Signal Research and Development Laboratory, with the title 'Technical Progress in Communication Wires and Cables.'

A testimonial dinner was held in Akron on December 15 in honour of P. W. Litchfield, who had just retired as chairman of the Goodyear Tire and Rubber Co.

Increased rayon tyre cord prices, by a matter of 2-3 cents/lb., became effective on December 22 in the US.

A scheme to exchange technical information was announced jointly by the US Rubber Co. and Farbenfabriken Bayer during December.

JANUARY

Home

The Council of the IRI meeting on January 27 approved the formation of a South African Section of the Institution with committees at Johannesburg, Durban, and Port Elizabeth.

A symposium on 'Some Newer Polymers: Their structure and uses,' was held at Manchester University on January 7 by the Plastics and Polymer Group of the Society of Chemical Industry, and the Royal Institute of Chemistry.

At a meeting in London on January 15 it was decided to change the name of the Rubber Footwear Manufacturers' Association to Rubber and Plastics Footwear Manufacturers' Association.

Mr R. W. Lunn was appointed chairman of Leyland and Birmingham Rubber Co. Ltd. in succession to the late Mr H. Berry. On the retirement of Mr H. V. Potter as chairman of Bakelite Ltd. on January 1, after 45 years' service to the company, he was succeeded by Mr Stanley Adams.

The New Year Honours List included the award of the M.B.E. to Dr W. R. Moore, reader in High Polymer Chemistry at Bradford Institute of Technology. Dr J. G. Mackay (managing director, Francis Shaw and Co. Ltd.) was made a C.B.E.

Overseas

News of an extensive entry by Australia into petrochemical manufacture was received in London during January. The proposed plant, at Altona, near Melbourne, will cost £A23m., including an investment of £A17m. by Vacuum Oil Co., who are to invite the participation of the Australian rubber industry, on plants for ethylene, butadiene, and a 30,000 tons/year synthetic rubber unit. A new styrene plant is to be built by C.S.R. Chemicals Pty. Ltd., in which the Distillers Co. Ltd. have a 40% interest.

The 15th Annual Technical Conference of the Society of Plastics Engineers was held in New York from January 27–30 on the theme of 'World-wide Advances in Plastics.' 3,000 members and guests attended the meeting at which nearly 100 papers were read.

THE AUTHOR

JOHN ACRES was born in London in 1931, *and educated in Nottingham and Leicester. From* 1953 *to* 1958 *he was employed in the Intelligence Division of the Research Association of British Rubber Manufacturers at Shawbury, and served as hon. secretary to the Midland Section of the Institution of the Rubber Industry from* 1956 *to* 1958. *A Licentiate of the IRI, he is now on the staff of the Library Department, Imperial Chemical Industries Ltd., Dyestuffs Division, at Blackley, Manchester. Living in Hazel Grove, Cheshire, with his wife and family his hobbies include Scouting, gardening and the countryside.*

A party of three men and a woman arrived in Barbados after a 3,000 mile Atlantic crossing by a balloon which featured a Neoprene-coated Terylene fabric. The last 1,200 miles were sailed in the balloon's gondola fabricated from expanded polystyrene reinforced with Terylene laminated fabric treated with isocyanates.

In the USA original equipment tyre prices were increased by from 1-2½% on January 1. Announcements of reductions of 0.7 cents/lb. in the prices of styrene monomer were made during January by Monsanto and by Dow. Low pressure polythene prices were reduced following an initial cut by Phillips from 43 to 38 cents/lb. (which compared with a conventional polythene price of 35 cents/lb., and polypropylene of 42 cents/lb.).

At Sarnia, Ontario, the high-density polythene plant of Dow Chemicals of Canada went on stream during January.

It was revealed that linear polythene is to be produced in France, near Le Havre, by La Manufacture Normande du Polyethylene. A joint Union Carbide-'Petrochim' venture, Cabenan S.A., to manufacture polythene in a plant of initial capacity in mid-1960 of 30m. lb./year near Antwerp, was announced.

Further details of the first Indian synthetic rubber plant at Bareilly, were announced. The plant capacity of 20,000-30,000 tons/year is to be based on an industrial alcohol consumption of 12 million gallons per year.

FEBRUARY

Home

The British Plastics Federation announced that exports of plastics raw materials during 1958 from the UK had achieved a record figure of 122,600 tons, at a value of £32m.

Rustyfa, the British consortium founded in 1957 to design and equip a new Russian tyre factory, revealed that it had received a further £1m. order for processing machinery, to bring the total order up to a value of £14m. B.T.R. Industries Ltd. announced that it had supplied nearly six miles of conveyor belting for a Russian ore field.

Shell Chemicals Ltd. announced plans for the construction of large-scale polyolefin facilities at the Petrochemicals Ltd. site near Manchester. Initial capacity for 30,000 tons/year of polythene or polypropylene production, under Ziegler licences, will include the first UK polypropylene plant.

The Fifth Annual Convocation of the National College of Rubber Technology was held in London on February 26. In his report as Principal of the College, Dr F. H. Cotton stressed the growing importance of the union of the rubber and plastics industries, and the need for a College of Polymer Technology.

A 20% reduction in the price of fluorinated silicone rubber was announced by Midland Silicones Ltd.

The Silver Jubilee Ball of the British Plastics Federation was held in London on February 20.

Sir George Beharrell, chairman of the Dunlop Rubber Co. Ltd. from 1937 to 1949, and President from 1949 to 1957, died at the age of 85 on February 20.

A new factory for Resinoid and Mica Products Ltd. came into production on February 1 at Reading.

Overseas

Plans for a 50,000 tons/year general purpose synthetic rubber plant at Berre, near Marseilles, were revealed by Société des Elastomères de Synthèse, a company formed by a group of tyre manufacturers, Cabot-Texas Butadiene, and two petroleum companies.

A meeting of Committee D-11 on Rubber and Rubber-like Materials of the ASTM in Pittsburgh on February 6 heard papers on outdoor exposure testing and on the uses of the Mooney cure test.

Luigi Emmanueli, vice-chairman of Pirelli SpA, died in Milan on February 17.

Plans for a new Firestone synthetic rubber plant at Orange, Texas, initially to produce 'Diene' rubber, and later 'Coral' polyisoprene at a capacity of 30,000 tons/year were announced.

Rubber manufacturers of the Common Market countries formed a liaison committee amongst themselves with provisional headquarters in Brussels.

News of plans for the production of polyvinyl chloride in Turkey, by Vinylex Ltd. at a factory near Istanbul, was released during February. A new Dunlop factory at Ambattur, near Madras, was opened on February 12. The factory, built at a cost of £1,800,000, will produce 2m. cycle tyres and 134,000 giant tyres annually.

MARCH

Home

By a decision of the Comptroller of Patents announced in London on March 13, the basic Terylene patents of the Calico Printers Association were extended for a period of five years from July 13 1958.

The Tenth Annual Lecture of the Plastics Institute was given in London on March 12 by S. P. Chambers, deputy chairman of Imperial Chemical Industries Ltd., who spoke on the subject of 'International Competition in the Chemical Industry.'

The 25th annual meeting of the British Plastics Federation was held on March 18. Mr H. V. Potter, retiring chairman, spoke on the growth of the plastics industry in the UK, which had developed from an output of 7,000 tons in 1930 to an estimated 400,000 tons in 1959.

Extensions to the Imperial Chemical Industries Ltd., Alkali Division, laboratories at Winnington, the home of the basic polythene discoveries, were opened on March 4. The General Chemicals Division of I.C.I. announced early in March plans for the construction of an acrylonitrile plant, to be the first large-scale plant of its kind in the UK.

The Minister of Transport and Civil Aviation visited the Microcell Group of companies at Camberley and Blackwater on March 6.

Sponge rubber covered hurdles were evaluated at Fontwell Park racecourse on March 16 at the direction of the National Hunt Committee.

A demonstration of the launching of inflated rubber liferafts from a single-arm davit on March 17 marked an important step forward in the eventual acceptance of these items as life-saving equipment for all classes of vessel.

Overseas

In the US the production of a polyisoprene synthetic rubber, at the rate of 5 tons a day and at a price of 30 cents/lb., was announced by the Shell Chemical Co. On March 10 US Rubber Co. simultaneously announced commercial production of truck tyres using this rubber in place of natural rubber.

The Rubber Manufacturers' Association and ten rubber companies were served with an indictment under the United States Sherman Anti-Trust Act, alleging illegal price fixing for flat conveyor and transmission belting products, on March 14.

News of a Ceylon/USSR agreement, to result in the establishment in Ceylon of a tyre and tube factory with Russian help, was reported early in March.

In Australia a study of the possibility of the commercial production of Guayule rubber was announced.

The foundation stone of a Montecatini petrochemical plant to produce 700,000 tons of petrochemicals annually was laid in Brindisi on March 8.

In an announcement in March a Dutch manufacturer, N.V. Bataafse Rubberindustrie Radium, at Maastricht, was licensed to use Firestone processes for the production of foam rubber.

P. W. Litchfield, who retired in October 1958 as chairman of the Goodyear Tire and Rubber Co., after a lifetime's career in the rubber industry, died in Phoenix, Arizona, on March 11 at the age of 83.

A Pelron Corpn. plant at Lyons, Ill., to produce expanded polyurethane resin went into production during March, together with a high-pressure polythene plant of U.S. Industrial Chemicals Co., at Houston, Texas, with a 75m. lb. per year capacity.

The first butyl rubber plant in Europe went into production during March when the 20,000 tons/year plant of the Société du Caoutchouc Butyl came on stream.

APRIL

Home

A symposium on 'Millrooms, Masticating, and Mixing' was held by the

Research Association of British Rubber Manufacturers from April 20-23 at Attingham Hall, near Shrewsbury.

A meeting of the Council of the Institution of the Rubber Industry on April 28 elected Dr Philip Schidrowitz as first life Vice-President of the Institution in recognition of his outstanding services to the Institution throughout the years.

Important applications of rubber and plastics materials were on display at the Corrosion Exhibition held in London from April 27-30. The Silver Jubilee Luncheon of the British Plastics Federation was held in London on April 22.

A group of delegates from the Russian plastics industry were touring British plastics manufacturers and suppliers during April.

Imperial Chemical Industries Ltd. announced its intention to introduce a polypropylene, to be manufactured at Wilton under Montecatini and Montecatini-Ziegler patents.

Overseas

The 11th annual rubber and plastics conference of the American Institute of Electrical Engineers was held in Akron, Ohio, from April 22-24. Processes and apparatus used by the rubber and plastics industries were discussed at a number of sessions.

The East German government announced plans for the expansion of its plastics production capacity, to a total figure estimated to reach 300,000 tons in 1965.

Continental Carbon Co. revealed plans for a 15,000 tons/year high abrasion furnace black plant at Rotterdam.

Malayan rubber export figures for the first quarter of 1959 showed Russia to be her leading customer, taking 16% of the total of nearly 300,000 tons of rubber exported.

MAY

Home

The biennial conference of the Oil and Colour Chemists Association in Edinburgh from May 5 to 9 discussed the relationship of polymers to the paint, printing ink, and allied industries.

The Board of Trade reported that net sales of plastics in the UK during 1958 totalled 416,000 tons, 6% higher than the 1957 figure.

'The Dracone' synthetic rubber-proofed nylon fabric flexible barge successfully completed a crossing of the North Sea on May 23 with a cargo of liquid hydrocarbons from Billingham. A 'Dracone' later began regular deliveries between the Esso refinery at Fawley and Newport, I.o.W., and Portsmouth.

Union Carbide Ltd. announced that their facilities for the production of polythene at Grangemouth were to be doubled by the erection of another 30,000,000lb./year plant, to go on stream in late 1960. More details of the design of the Russian tyre plant at Dniepropetrovsk, to be equipped by the British consortium Rustyfa, were released early in May.

The IRI Foundation Lecture was given in London on May 29 by Dr J. R. Scott on 'Co-operative Research in the Rubber Industry.'

An exhibit on behalf of the rubber industry was organized and mounted by the Publicity Committee of the Federation of British Rubber and Allied Manufacturers at the National Education and Careers Exhibition which opened at Olympia on May 26. At the annual general meeting of the Federation in London on May 28 Mr H. G. W. Chichester-Miles (chairman, Empire Rubber Co. Ltd.) was elected president.

At the general meeting of the Rubber Growers' Association held in London on May 8 Mr T. H. Miller was appointed chairman in succession to Mr A. W. Wallich. The retiring chairman commented on the successful year experienced by the majority of the plantation industry, with a new record figure of 1.98m. tons as natural rubber's share of new rubber consumption.

A new monthly periodical for the rubber industry was introduced during May. 'Soviet Rubber Technology' is a cover to cover translation of 'Kauchuk i Rezina,' prepared by the Research Association of British Rubber Manufacturers under the auspices of the DSIR Translation Unit and published by Maclaren and Sons Ltd., proprietors of *RJIP*.

Overseas

The meeting of the Division of Rubber Chemistry of the American Chemical Society in Los Angeles from May 13-15 included symposia on 'The Effect of Ozone on Rubber' and on 'Urethane Foams and Elastomers.'

An International Tyre Symposium organized by the Institut Français du Caoutchouc was held in Paris from May 20-22. Delegates from Russia, Czechoslovakia, UK, US, Germany, Finland, Sweden, Switzerland, Belgium, Spain, France, Italy, Thailand, and Luxembourg were present.

The annual meeting of the Sveriges Gummitekniska Forenings in Sweden on May 22 and 23 included a symposium on white reinforcing fillers, and a shorter symposium on automatic processing and testing techniques.

The United States Rubber Co. signed new agreements with United Rubber Workers on May 1 to end a strike of 24,000 of its employees.

Polythene and vinylidene chloride facilities were included as part of a $12m. expansion scheme revealed for the Dow Chemical Co., Louisiana Division. Hercules Powder Co. announced plans to raise polypropylene capacity at its Parlin plant to 50,000,000lb./year, and also plans for a new polypropylene plant.

The first Indian large scale polythene plant was opened at Rishra on May 2, with a capacity of 3,500 tons/years of high-pressure polythene, using ethyl alcohol as its source of ethylene.

At the annual dinner of the Rubber Association of Canada in Toronto on May 26 E. R. Rowzee (president, Polymer Corpn. Ltd.), spoke on 'The Changing Personality of Synthetic Rubber.' The Division of Rubber Chemistry, Chemical Institute of Canada annual conference at Niagara Falls, on May 1, included a symposium on 'Ageing and Weathering of Elastomers.'

Plans to double the capacity of the Alliance tyre factory in Israel to bring production capacity to a rate of 7,500 tons/year were announced.

In the US, F. H. Banbury was the 1959 recipient of the Goodyear Medal of the American Chemical Society.

JUNE

Home

A strike in the printing industry from mid-June to August severely interrupted the dissemination of information through the trade and technical Press.

At the Plastics Institute Dinner in London on June 26 the Institute's first Gold Medal was presented to Dr N. J. L. Megson for his paper 'Modern Ideas on Polymer Formation,' and J. M. Buist and Dr A. Lowe received the Silver Medal for their paper 'Polyurethanes, their Properties and Applications.'

The International Plastics Exhibition and Convention was held at Olympia from June 17-27.

At the annual general meeting of the Research Association of British Rubber Manufacturers at Shrewsbury on June 3, D. B. Collett, chairman of council, in his address to members referred to the recent progress of the Association. The meeting was followed by a luncheon and a presentation to Dr J. R. Scott, who retired as Director in November 1958.

New technical service laboratories were opened for the Distillers Co. Ltd. at Carshalton on June 11 by W. Reid, chairman of the management committee.

R. T. Cooke, chairman of Francis Shaw Ltd., died on June 12.

Overseas

Strikes which had been threatening the prosperity of the rubber industry in both the US and in Canada were settled during June. After the successful Goodyear negotiations in April, and the US Rubber settlement in May, it was only after a prolonged strike that Goodrich reached agreement with the United Rubber Workers Union on June 9, to be followed by Firestone on June 12. A figure of 55,000 workers involved in the dispute, over wages and conditions, was quoted. In Canada the Polymer Corpn. reached agreement with local union leaders on June 23 to settle a strike which had lasted 97 days at its Sarnia plant.

The Fifth Salon de la Chimie held in Paris during June included sub-

exhibitions devoted to plastics and rubber materials, laboratory equipment, and chemical engineering and corrosion protection. In Frankfurt on June 11 a meeting of the Overseas Section of the Society of Chemical Industry heard a paper by Dr P. Baumann, research director of Chemische Werke Hüls on 'The Present State of Our Knowledge of Synthetic Elastomers.' Dr J. Swallow, chairman of I.C.I. Plastics Division gave a paper on '25 years of Polyolefins.'

Plant developments in the US during June included the plans of Montecatini for a $10m. polypropylene and polyolefin plant at Neal, W.Va., and the opening by Dewey and Almy Chemicals Division of a plant to manufacture vinyl acetate polymers and copolymers, butadiene-styrene latices and battery separators, with a total capacity of 20,000,000lb./year.

Kanegafuchi Chemical Co. announced plans for a 5 tons/month pilot plant to produce polychloroprene, to be in production in November, with an eventual capacity of 300 tons/month.

JULY

Home

The Plastics Institute announced the institution of the Swinburne Medal to commemorate the late Sir James Swinburne, to be awarded for outstanding contributions to the science, engineering, or technology of plastics. At the Plastics Institute annual general meeting in London on July 22 Mr H. F. Wilson (managing director, Telegraph Construction and Maintenance Co. Ltd.) was elected President.

The British Geon Ltd. Hycar plant at Barry, Glamorgan, was shown to the technical Press during July. The plant, built at a cost of £200,000, has a present capacity of 4,000 tons/year.

Imperial Chemical Industries Ltd. announced plans for the full-scale production by 1960/61 of its 'Melinex' polyester film at a plant near Dumfries. The availability of coloured polypropylene from Shell Chemical Co. Ltd. at a price of 3s. 9d. lb. was announced.

Professor Karl Ziegler was presented with the scrolls of honorary membership of the Society of the Chemical Industry, at the annual dinner of the Society in Glasgow on July 8.

Overseas

In the US, the Goodyear Tire and Rubber Co. reduced its tyre prices on July 21, to be followed by the other American producers.

The United States Rubber Co. and the Firestone Tire and Rubber Co. were indicted by two separate Federal juries under the Sherman Anti-Trust Act, on charges of illegally fixing the prices of synthetic rubber foam mattresses.

Shell Chemical Corpn. announced the installation of a Cobalt-60 irradiation unit at their synthetic rubber division research laboratories at Torrance, and also plans for a 20,000 tons/year polyisoprene plant at Torrance, California.

Mobay Chemical Co. started construction of plant for production of polycarbonate resins at New Martinsville, W.Va. General Tire and Rubber Co. started production in its expanded facilities for styrene-butadiene latices at Mogadore, Ohio.

In Australia, Goodyear Tire and Rubber Co. (Australia) Ltd. revealed that they had acquired an interest in the synthetic rubber plant under erection at Altona, near Melbourne, by the Australian Synthetic Rubber Co. The plant is scheduled for completion in July 1961 to produce 30,000 tons/year of styrene-butadiene rubbers.

News was made available of a projected 20% increase in output by the end of 1960 for the Schkopau Buna works in Eastern Germany. Vinyl chloride production is to be at the rate of 9.700 tons/year by the end of 1959, polystyrene 11,000 tons/year in 1961.

Sir Geoffrey Clay, Controller of Rubber Research to the Malayan Rubber Fund Board, spoke at a luncheon in New York on July 20, and later revealed that the funds then available for research on natural rubber, as a result of the cess on rubber production, amounted to $3½m.

News was released of Columbian Carbon Co. plans for a $6m. carbon black factory, with a capacity of 60m. lb./year, near Milan, to be in operation by early 1961.

Amoco Chemicals revealed plans for the manufacture of polystyrene at Joliet, Ill.

AUGUST

Home

It was announced that the 1959 Hancock Medal of the Institution of the Rubber Industry was to be awarded to Mr J. H. Carrington (technical director, Anchor Chemical Co. Ltd.).

Reductions of 7½% on car tyre prices effective on August 8 were announced by Dunlop, Firestone, Goodyear, Avon, and Kelly Springfield.

On August 26 the British Motor Corporation introduced a revolutionary new 'baby car' which featured an independent suspension system based on four rubber/metal units, together with rubber couplings in the half-shafts driving the front wheels.

Mr Fred Train was appointed chairman of John Bright and Bros. Ltd., Rochdale.

Overseas

A Gordon Research Conference on 'Chemistry of Adhesion' was held in the US from August 31 to September 4.

In Malaya news was released during August of a $10m. (Malayan) project of the Malayan Tyre Corpn., to manufacture tyres at a factory at Petaling, near Kuala Lumpur, with technical assistance to be provided by the Dayton Rubber International Co., Ohio.

In the US, Du Pont announced plans for its second conventional polythene plant, to be completed in early 1961, and to produce at the rate of 60,000,000lb./year. This plant is to be at Victoria, Texas.

In France, the Goodyear Tyre and Rubber Co. selected a 75-acre site in Amiens, near Paris, for a $7m. tyre and tube manufacturing plant.

A project for a petrochemicals plant near Beersheba was being studied by the Israeli Government. The scheme using feedstock from a Haifa refinery includes the erection of a polythene plant.

SEPTEMBER

Home

In early September the Board of Trade announced that it was to liquidate its strategic stockpile of 100,000 tons of rubber. This followed similar news, a day earlier, from the US that 470,000 tons of rubber were to be released over a period of nine years. Effect of these announcements was to cause the London market price of rubber to drop by over 1d.

The British Association for the Advancement of Science annual meeting opened in York on September 3.

The Packaging Exhibition opened in London on September 8. A range of rubber and plastics components were on view on the trade stands at the Society of British Aircraft Constructors' Exhibition at Farnborough from September 7-13.

The remarkable summer of 1959 brought the plastics industry into the news on September 20 when plastics pipelines were used to provide emergency water supplies to areas of North Devon, and also to link Manchester supplies to Stockport.

The 1959 Horners Award was won by Mr P. D. Durden for his design of a domestic hand suction cleaner.

A 10% reduction in the price of fluorinated silicone rubber, effective from September 9 was announced by Midland Silicones Ltd.

Mr G. H. Redman, managing director, J. E. Baxter and Co. Ltd., Leyland, died on September 6 at the age of 76.

The construction started of a new plant to produce a general purpose synthetic rubber latex, at the rate of 2½m. gallons/year, at the Southampton site of the International Synthetic Rubber Co. Ltd.

On the tenth anniversary of the opening of the Wilton petrochemicals plant of Imperial Chemical Industries Ltd., September 14, it was announced that the third olefine plant, recently commissioned, raised the olefine capacity of the plant by 60%.

Overseas

An American export firm announced a one million dollar sale to the USSR of machinery for the manufacture of plastics pipe.

Dow Chemical Co. announced plans for the setting up of a long-range plastics application laboratory at its Midland, Mich., headquarters.

UK Exports of Rubber Products

PROGRESS OF TRADE DURING RECENT YEARS

Statistics Specially Compiled from Official Sources by the Federation of British Rubber and Allied Manufacturers. A graph showing UK exports of general rubber products other than tyres and tubes in recent years is given on page 430.

(a) General Rubber Goods (excluding Tyres and Tubes)

Group 'A'—RUBBER MANUFACTURES—comprises sheeting, composition soling sheet, rubberized or proofed fabrics, printers' blanket, thread, hose, flooring, ebonite, other rubber - fabricated materials (including tubing), surgical products, gloves, cellular (including latex foam products), adhesives, compounds and solutions, hot water bottles, bands, erasers and various manufactures of rubber and synthetic rubber such as industrials and mechanicals.

Group 'B'—BELTING — comprises balata belting, rubber and rubber reinforced with other materials, conveyor and transmission belting, motor vehicle fan belts and PVC belting. 1959 is the first year in which figures have been made available by the Board of Trade for PVC belting.

Group 'C' — FOOTWEAR — comprises industrial boots, Wellingtons, rubber bootees, overshoes and goloshes and rubber-soled canvas footwear, and soles and heels.

Group 'D' — TOYS AND BALLS — comprises golf and tennis balls, other balls for sports and games, balloons and rubber toys, and football and other bladders.

ALL COUNTRIES
(Figures in £ Sterling)

	Year 1956	Year 1957	Year 1958	First 6 mths 1959
Rubber Manufactures (Group 'A')				
Sheets and sheeting	511,508	509,802	566,401	269,657
Rubberized or proofed fabrics	1,542,031	1,685,640	1,587,260	753,377
Thread	555,628	579,442	496,788	230,332
Hose	2,189,113	2,219,574	2,442,039	1,130,507
Flooring	323,478	273,232	351,482	192,684
Ebonite, etc.	348,133	388,424	298,976	104,984
Other rubber fabricated materials	76,728	77,041	155,451	155,010
Surgical products	531,241	649,712	667,427	400,154
Hot-water bottles	277,933	247,051	213,219	65,828
Cellular rubber	1,155,140	915,880	800,634	339,828
Other products	2,912,951	3,169,173	3,764,519	1,992,438
Total	10,423,884	10,714,971	11,344,196	5,634,799
Belting (Group 'B')				
Balata	145,732	140,355	147,454	74,527
Rubber, and reinforced rubber conveyor and transmission	2,313,587	2,880,043	2,658,037	1,537,037
Motor vehicle fan belts	188,714	171,909	221,965	98,499
PVC belting	—	—	—	271,710
Total	2,648,033	3,192,307	3,027,456	1,921,773
Footwear (Group 'C')				
Boots and shoes	1,828,670	1,758,887	1,646,483	690,199
Soles and heels	398,022	276,924	274,783	129,874
Total	2,226,692	2,035,811	1,921,266	820,073
Toys, Balls, etc. (Group 'D')				
Golf and tennis balls	1,192,791	1,342,763	1,320,282	844,733
Other toys, balls and bladders	242,987	223,305	213,005	85,005
Total	1,435,778	1,566,068	1,533,287	929,738

(Figures in £1,000 Sterling)

Group	Year 1956	Year 1957	Year 1958	First 6 mths 1959
AUSTRALIA				
'A'	669.4	704.4	763.2	330.7
'B'	95.0	103.5	85.8	36.1
'C'	22.1	20.7	23.9	6.9
'D'	29.9	23.8	41.1	22.2
AUSTRIA				
'A'	58.0	46.8	53.8	22.0
'B'	5.1	7.2	6.4	2.1
'C'	58*	1.6	117*	68*
'D'	14.3	14.2	13.8	14.7
BELGIUM				
'A'	404.2	421.5	319.4	147.4
'B'	99.4	96.8	92.8	63.2
'C'	41.1	44.8	36.3	14.4
'D'	30.4	31.2	28.5	24.4
BELGIAN CONGO				
'A'	22.5	16.8	11.4	7.5
'B'	44.7	38.9	65.6	9.1
'C'	6.5	9.0	289*	431*
'D'	5.3	6.9	6.8	2.3
BURMA				
'A'	57.5	64.2	59.5	32.9
'B'	84.2	71.1	24.1	10.1
'C'	6.4	8.1	8.8	7.9
'D'	17.5	10.8	16.7	6.0

Group	Year 1956	Year 1957	Year 1958	First 6 mths 1959
CANADA				
'A'	365.8	398.2	474.8	301.1
'B'	90.4	154.9	237.3	117.1
'C'	294.1	239.6	261.2	119.4
'D'	170.4	149.9	135.0	85.1
CEYLON				
'A'	64.6	75.9	72.9	40.8
'B'	20.3	17.1	19.8	11.3
'C'	2.2	2.2	3.0	1.7
'D'	6.9	5.2	5.9	1.6
CHILE				
'A'	39.6	45.9	36.5	25.0
'B'	85.7	86.4	127.8	59.0
'C'	2.0	2.5	4.3	2.9
'D'	7.7	7.8	4.7	791*
CUBA				
'A'	56.8	37.1	36.5	9.0
'B'	3.6	4.3	10.1	2.7
'C'	6.4	14.6	13.8	1.4
'D'	12.1	13.5	12.3	4.0

**Actual figures not £1,000*

UK Export of Rubber Products

(Figures in £1,000 Sterling)

Group	Year 1956	Year 1957	Year 1958	First 6 mths 1959
CYPRUS				
'A'	34.9	57.1	40.2	18.5
'B'	18.1	14.8	12.4	7.1
'C'	58.3	54.9	21.2	10.1
'D'	2.0	4.0	4.6	629*
DENMARK				
'A'	259.1	265.5	274.9	133.3
'B'	21.7	16.1	21.1	8.7
'C'	13.4	11.2	9.2	5.8
'D'	11.8	10.7	10.5	9.3
UNITED ARAB REPUBLIC (EGYPT AND SYRIA)				
'A'	(75.2)†	(2.1)	37.1	36.6
'B'	(20.1)	(471*)	14.6	5.9
'C'	(5.1)	(210*)	1.8	1.0
'D'	(4.8)	(457*)	5.4	4.8
FINLAND				
'A'	145.9	145.9	231.3	120.1
'B'	14.5	5.2	30.6	11.0
'C'	421*	—	1.3	80*
'D'	2.9	735*	788*	1.4
FRANCE				
'A'	288.0	260.6	225.2	96.4
'B'	48.0	45.8	33.0	21.2
'C'	5.4	4.0	6.5	1.1
'D'	37.9	46.2	40.8	25.4
GERMANY (WESTERN)				
'A'	180.7	220.7	417.7	221.4
'B'	3.7	1.0	10.0	2.8
'C'	13.3	10.7	19.8	9.6
'D'	64.1	62.3	58.8	46.5
GHANA				
'A'	152.2	182.4	214.6	95.6
'B'	43.9	34.9	52.4	29.7
'C'	21.0	29.3	25.9	11.1
'D'	4.9	3.7	4.4	2.3
GREECE				
'A'	32.9	41.7	39.6	27.4
'B'	9.4	8.4	13.4	12.2
'C'	634*	823*	477*	494*
'D'	1.6	1.5	2.1	541*
HONG KONG				
'A'	123.9	153.1	152.8	46.8
'B'	15.0	17.5	14.5	6.2
'C'	18.7	10.3	9.8	7.4
'D'	41.8	56.6	59.4	29.5
ICELAND				
'A'	53.6	47.5	40.3	18.1
'B'	6.4	7.0	8.5	3.8
'C'	2.5	1.2	2.7	1.2
'D'	731*	281*	240*	14*
INDIA				
'A'	165.0	173.7	155.6	65.6
'B'	207.3	365.5	124.8	60.0
'C'	3.2	1.0	703*	2.5
'D'	43.2	34.1	15.0	4.3
INDONESIA				
'A'	68.8	49.2	50.7	22.4
'B'	85.9	22.7	15.5	38.2
'C'	4.2	3.4	886*	1.2
'D'	33.4	81.0	15.3	22.4
IRAN				
'A'	216.2	176.8	147.7	244.2
'B'	19.1	25.9	17.1	8.2
'C'	13.4	21.5	46.7	4.1
'D'	2.0	3.3	3.4	3.6

†*Figures in parenthesis are for Egypt only*

Group	Year 1956	Year 1957	Year 1958	First 6 mths 1959
IRAQ				
'A'	110.0	94.7	84.4	26.2
'B'	26.3	25.0	21.8	9.0
'C'	10.6	12.7	8.8	6.3
'D'	2.9	4.5	4.4	852*
IRISH REPUBLIC				
'A'	732.1	641.4	732.5	368.3
'B'	96.6	79.6	87.2	43.4
'C'	56.7	68.7	79.4	29.9
'D'	15.1	13.2	18.5	7.6
ITALY				
'A'	318.6	420.4	498.4	204.3
'B'	9.4	18.6	59.0	22.4
'C'	1.0	3.9	3.9	1.3
'D'	15.6	22.4	26.0	17.5
JAMAICA				
'A'	117.8	100.2	118.7	41.1
'B'	24.8	17.7	38.5	19.7
'C'	170.0	158.0	135.6	61.2
'D'	9.8	8.7	9.4	6.7
KENYA, TANGANYIKA-UGANDA				
'A'	171.7	125.1	144.0	69.6
'B'	60.3	55.5	57.9	35.5
'C'	62.2	83.0	70.7	41.1
'D'	5.9	8.7	7.2	3.6
KUWAIT				
'A'	124.3	130.3	179.3	42.6
'B'	10.1	6.7	8.8	4.1
'C'	18.8	1.9	2.4	858*
'D'	1.2	1.2	1.8	221*
LEBANON				
'A'	(100.2)‡	(69.4)	39.1	36.4
'B'	(9.2)	(7.4)	4.2	2.3
'C'	(9.6)	(10.8)	7.2	3.0
'D'	(4.2)	(6.1)	5.2	1.1
MALAYA AND SINGAPORE				
'A'	327.9	274.8	228.6	112.0
'B'	92.2	100.2	61.0	30.2
'C'	121.0	43.6	65.5	16.7
'D'	31.9	35.1	53.2	13.4
MALTA AND GOZO				
'A'	39.7	48.7	47.4	22.5
'B'	2.8	2.7	20.6	3.0
'C'	6.6	6.8	8.0	3.1
'D'	1.6	2.6	2.2	1.2
NETHERLANDS				
'A'	627.0	654.6	556.9	252.3
'B'	75.9	78.4	90.0	67.5
'C'	11.7	5.6	5.6	1.7
'D'	36.9	41.5	41.5	29.7
NETHERLANDS ANTILLES				
'A'	51.2	41.9	35.3	18.5
'B'	571*	1.8	2.7	240*
'C'	9.9	5.8	3.8	2.1
'D'	3.0	2.5	3.2	1.8
NEW ZEALAND				
'A'	557.4	648.9	638.9	180.3
'B'	212.0	170.8	239.7	109.5
'C'	94.7	68.0	53.5	7.3
'D'	98.8	99.5	96.6	61.2
NIGERIA				
'A'	149.8	179.4	221.0	110.6
'B'	20.3	23.3	27.1	9.2
'C'	183.8	108.9	214.9	66.8
'D'	7.5	9.8	8.9	5.9

‡*Figures in parenthesis are for Lebanon and Syria combined*

* *Actual figures not* £1,000

UK Exports of Rubber Products

(Figures in £1,000 Sterling)

Group	Year 1956	Year 1957	Year 1958	First 6 mths 1959
NORWAY				
'A'	304.4	290.3	314.7	150.5
'B'	14.9	10.6	10.1	3.6
'C'	3.3	3.6	10.1	1.7
'D'	3.3	3.7	3.2	3.7
PAKISTAN				
'A'	90.1	123.2	78.0	41.9
'B'	45.5	41.8	56.8	15.8
'C'	7.6	1.0	—	1.1
'D'	4.5	5.3	9.3	3.3
PERU				
'A'	93.7	74.8	61.0	19.2
'B'	51.2	36.0	28.4	33.6
'C'	7.4	2.3	1.6	1.8
'D'	3.3	4.2	5.0	2.3
PORTUGAL				
'A'	86.5	73.8	73.3	42.8
'B'	35.4	30.4	30.0	22.4
'C'	32.1	24.4	29.1	11.4
'D'	3.3	2.4	3.5	1.2
FEDERATION OF RHODESIA AND NYASALAND				
A'	117.3	112.0	100.8	57.2
'B'	71.9	86.1	194.4	52.1
'C'	92.7	114.6	66.4	34.4
'D'	19.6	23.6	22.4	8.9
SAUDI ARABIA AND JORDAN				
'A'	49.5	45.6	68.5	21.5
'B'	3.9	5.7	7.1	2.2
'C'	42.0	33.7	16.8	3.0
'D'	1.7	1.5	3.2	1.4
SIERRA LEONE				
'A'	13.9	22.7	25.8	11.2
'B'	24.7	31.5	35.1	24.6
'C'	43.0	26.4	20.2	8.3
'D'	1.7	1.6	1.8	387*
SWEDEN				
A'	609.0	653.3	672.5	291.7
'B'	53.5	41.3	55.2	17.8
'C'	10.4	13.8	12.6	5.8
'D'	31.6	39.2	44.1	19.2
SWITZERLAND				
'A'	201.5	195.6	220.4	121.4
'B'	77.3	65.6	56.0	21.8
'C'	7.7	3.9	5.8	3.9
'D'	27.3	31.3	31.5	23.8
THAILAND				
'A'	95.3	68.8	59.4	31.0
'B'	30.5	25.9	25.3	12.4
'C'	56.8	332*	664*	726*
'D'	9.2	10.0	11.3	7.7
TRINIDAD AND TOBAGO				
'A'	89.1	109.8	113.3	66.4
'B'	13.7	11.1	11.9	7.0
'C'	154.2	123.2	123.2	47.9
'D'	6.6	9.2	9.2	3.5
TURKEY				
'A'	12.4	34.5	18.6	15.6
'B'	100.3	8.6	36.3	23.8
'C'	170*	1.3	135*	1*
'D'	1.6	522*	1.8	1.9
UNION OF SOUTH AFRICA				
'A'	585.8	587.3	656.0	261.1
'B'	161.6	266.3	348.6	116.1
'C'	13.9	13.9	11.6	10.9
'D'	96.3	100.2	100.3	49.4
USA				
'A'	268.6	312.2	391.2	401.8
'B'	9.3	27.0	25.7	36.7
'C'	105.9	231.3	183.1	110.6
'D'	154.6	221.8	224.9	194.1
VENEZUELA				
'A'	172.6	222.2	174.9	93.5
'B'	55.9	55.2	31.1	16.0
'C'	4.3	13.0	19.6	6.3
'D'	24.9	31.3	33.8	21.0

Actual figures not £1,000

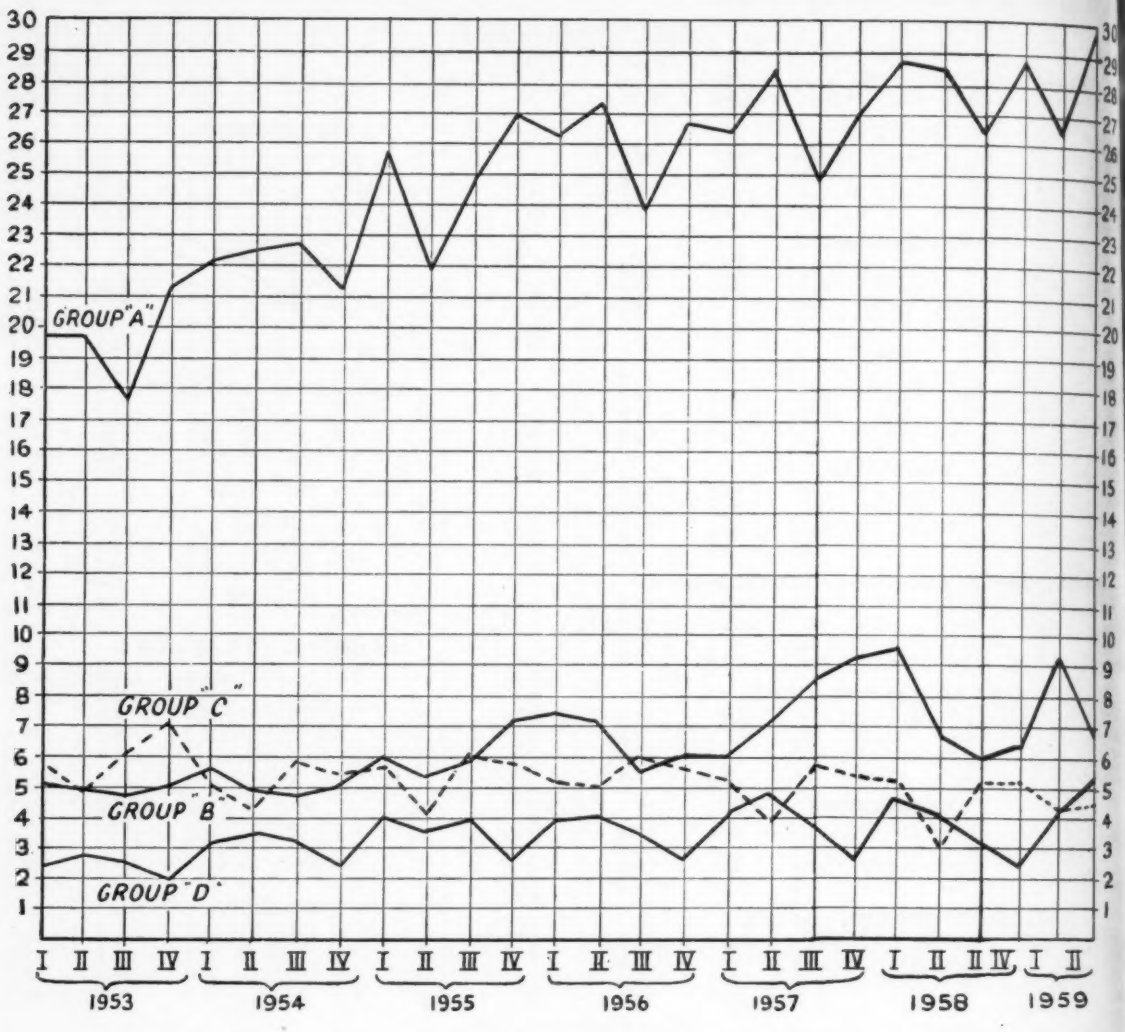
(b) Tyres and Tubes

ALL COUNTRIES

(Figures in £1000 Sterling)

	Year 1956	Year 1957	Year 1958	First 6 mths 1959
Outer Covers				
For aircraft	687.8	814.3	624.6	402.0
For motor-cycles and tri-cycles	378.3	434.7	434.3	233.6
For other motor vehicles:				
New giant	14,722.8	13,706.2	10,501.7	5,426.8
New tractor and dumper and earth mover vehicle	2,009.2	2,151.5	2,205.7	1,188.2
New other sorts	4,845.5	4,762.1	5,293.1	2,904.1
Reconditioned or used giant	139.1	111.0	91.8	39.7
Reconditioned or used other sorts	380.0	355.7	418.3	237.8
For cycles	1,970.0	1,526.9	1,700.0	758.0
Other sorts	224.6	226.3	170.0	87.4
Total	25,357.3	24,088.7	21,439.8	11,277.9

	Year 1956	Year 1957	Year 1958	First 6 mths 1959
Inner Tubes				
For aircraft	52.0	53.6	48.8	20.1
For motor-cycles and tri-cycles	60.7	77.0	80.0	44.4
For other motor vehicles:				
Giant	793.2	739.0	626.5	332.8
Tractor and dumper and earth mover vehicle	103.2	136.0	124.3	75.2
Other sorts	428.9	488.5	528.9	270.1
For cycles	362.4	403.7	557.8	239.9
Other sorts	19.1	22.1	19.0	17.4
Total	1,819.5	1,919.9	1,985.6	1,000.2
Cushion and solid tyres	68.1	70.7	61.3	30.7
Camelback and other tyre repair materials	799.7	714.1	719.6	348.3
Grand Total	28,044.6	26,793.4	24,296.4	12,657.3



Graph showing UK exports (by value) of rubber products other than tyres and tubes, by quarters 1953, 1954, 1955, 1956, 1957, 1958 and January to June 1959

Contents of Groups 'A' (Rubber Manufactures), 'B' (Belting), 'C' (Footwear) and 'D' (Toys and Balls) are given in detail on page 427. Figures on the vertical scale represent £100,000.

COMMENTS ON THE EXPORT GRAPH

Total exports of general rubber goods (excluding tyres and tubes) continue to show an increase on previous years. The total figures at the end of the year were slightly in advance of 1957 and the figures at the end of the first half of 1959 show a lead over the same period of 1958. Rubber manufacturers are contributing their share to the improvement in trade and the increasing prosperity of the country as a whole.

Group 'A'—Rubber Manufactures

Exports in Group 'A' rose sharply in the last quarter of 1958 and although they dropped again in the next quarter they rose to a new peak in the second quarter of this year. If the second half of 1959 fulfils expectations the year will prove another excellent trading year for this group.

Group 'B'—Belting

Export sales of belting which had been declining throughout the second and third quarters of 1958 levelled out in the last quarter and showed a sharp recovery in the first quarter of 1959. In a number of foreign markets sales have been hampered by lack of sterling exchange.

Group 'C'—Footwear

Exports of footwear have fluctuated during the period under review but the latest figures are a little more encouraging. The trend which showed a seasonal drop in the second quarter of each year has been arrested in 1959 and reversed. It is too soon perhaps to attach significance to this unusual feature but it is interesting.

Group 'D'—Toys and Balls

Group 'D' exports fell again in the last quarter of 1958 but have risen steadily to a new peak during the first half of 1959. This group appears to be enjoying a very good year.

Rubber Statistics

JAPAN—WESTERN GERMANY—SOLE CREPE—FRANCE

IMPORTS of natural rubber into Japan during the period ended April 30 last totalled 47,998 tons compared with imports of 37,773 tons during the same period of last year. Of this total, Malaya supplied 37,577 tons.

Consumption of natural rubber during these four months amounted to 44,090 tons of crude and 4,000 tons of latex, or 48,090 tons in all as against 38,380 tons in 1958. In fact, this year both imports and consumption of natural rubber have increased by around one-quarter over the 1958 figure. Stocks of natural rubber on hand at the end of April were almost unchanged compared with the level prevailing at the beginning of the year, with 14,988 tons as against 15,079 tons.

Imports of synthetic rubber during these months amounted to 8,886 tons, including 7,082 tons from the USA and 1,571 tons from Canada. Consumption during the same period totalled 8,410 tons; in 1958, the figure for consumption had been 5,150 tons. Stocks of synthetic on hand at April 30 stood at 3,526 tons, having risen some 500 tons since the beginning of the year.

Thailand

Details of Thailand's rubber exports during the second quarter of the year have recently been published. These totalled 12,227 tons in April, 13,139 tons in May and 4,875 tons in June, making 30,241 tons in all for the quarter as against exports of 52,460 tons during the period January to March of this year.

Of the half-year's total, by far the greater proportion went to the USA, with 57,622 tons or 70%. Next in order of importance came Malaya, taking 15,166 tons. Other countries taking Thailand's rubber during this half-year included the UK (2,137 tons), Western Germany (2,085 tons), Japan (4,454 tons), and Hong Kong (536 tons).

Sole Crepe Exports

Details of sole crepe exports from Malaya, Ceylon and Vietnam are now available for the month of July.

In the case of Malaya, these totalled 690 tons, of which 198 tons went to the UK, 123 tons to France, and 108 tons to Spain. These exports brought the total up to the end of July to 4,231 tons, a reduction of some 1,600 tons compared with the previous year's figure.

Ceylon's exports of sole crepe amounted to 45 tons, and those of Vietnam totalled 80 tons. Ceylon's exports to the end of July totalled 353 tons, while those of Vietnam totalled 156 tons.

Western Germany

The increasing extent to which synthetic rubber is being used in Western Germany is shown in the breakdown of the consumption figures for the first half of the year, which have recently been released.

In the case of tyres and tyre products, natural rubber accounted for 66.27% of all the rubber consumed last year, compared with 69.52% the year before, and 78.94% in 1956. During the period January to June of this year, the monthly breakdown shows a progressive decline from 67.62% to 63.93%.

In the case of non-tyre products, the percentage of natural rubber used is higher. Last year it stood at 74.76% compared with 79.08% in 1957 and 78.70% in 1956. During the first six months of this year it declined progressively from 75.27% to 72.25%.

France

The French Customs Board announces that imports of natural rubber during August totalled 10,617 tons compared with 8,353 tons in July. Imports of smoked sheets rose from 4,599 tons to 6,533 tons, while imports of miscellaneous sheets and crepes rose from 2,104 tons to 2,462 tons; latex imports fell from 1,314 tons to 1,075 tons. Malaya was the main supplier of this rubber, with 892 tons of latex, 3,196 tons of smoked sheets, and 1,688 tons of miscellaneous sheets and crepes.

Imports of synthetic rubber during August amounted to 4,793 tons, having totalled 4,534 tons in July. Polybutadiene/styrene imports rose from 3,348 tons to 5,067 tons, butyl from 425 tons to 433 tons and polychlorobutadiene from 368 tons to 719 tons. Of the total amount, the USA supplied 5,678 tons in August and 4,124 tons in July.

World Position

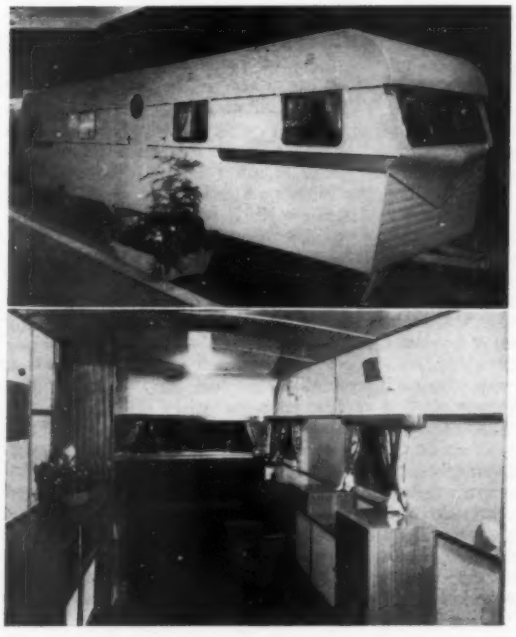
The International Rubber Study Group has made the following revisions to its statistics for June and July:

In June: World consumption of natural rubber amounted to 190,000 long tons (net 182,500), including estimated imports into China of 10,750 long tons (2,750). Stocks at the end of June totalled 675,000 long tons (680,000) including 265,000 tons in producing areas (267,500) and 207,500 tons in consuming areas (210,000). Synthetic rubber production totalled 111,488 long tons (112,500).

In July: Exports from Indonesia amounted to 53,291 long tons (50,791).

Dunlop Cord for Cross-bows

An order for nearly two tons of rubber cord, one-eight of an inch thick, has been received by Dunlop's general rubber division in Manchester. It is for fitting to toy cross-bows which are in great demand owing to the influence of the television William Tell and Robin Hood series.



'Warerite' wallboard manufactured by Bakelite Ltd. is being used by Bessacarr Caravans Ltd., Rawsham, near Rotherham, for the panelling throughout of the new 'Manor' caravan. This caravan, which is made in two units, each 17 ft. long and 8 ft. wide, is divided into three rooms—lounge, bedroom and kitchen. Designed for use on permanent caravan sites, it was shown at the recent International Caravan Show at Earls Court, London

PATENT SPECIFICATIONS

The following information is prepared from published Patent Specifications by permission of the Controller of H.M. Stationery Office. The full Specifications can be obtained from the Patent Office, 25 Southampton Buildings, W.C.2, at 3s. 6d. per copy (including postage).

Silica Pigments

No. 813,453. Columbia-Southern Chemical Corporation. Application and Filed, December 7 1955. Application in USA, December 14 1954. Published, May 13 1959.

A coating of an unsaturated organopolysiloxane is applied to a finely-divided, hydrated silica pigment having a surface area of 25 to 250 sq. metres per gm. and an average ultimate particle size below 0.1 micron. The pigment contains at least 75% of SiO_2 by weight on a water-free basis and bound water in an amount corresponding to the formula $H_2O(SiO_2)_x$, where x is 3 to 85. Compared with untreated silica pigments, the treated pigments, when incorporated in rubber, improve the resistance of the rubber to wear and improve the tensile strength, modulus and tear properties of the rubber. Data are included to show the improvement effected in natural rubber and SBR compositions.

Thermoplastic Graft Polymers

No. 814,393. Union Carbide Corporation. Application and Filed, August 29 1955. Application in USA, August 30 and September 9 1954. Published, June 3 1959.

Graft polymers of polythene are made by reacting a polythene homopolymer with a polymerizable monomer having a single ethylenic unsaturated group in the molecule. The reaction is carried out in the presence of a polymerization catalyst of the free-radical promoting type, preferably a peroxide catalyst such as benzoyl peroxide. Suitable polymerizable monomers include vinyl esters, vinyl halides and acrylonitriles. The graft polymers retain many of the original properties of polythene, but due to the presence of the chemically-attached side-chains, they have properties unobtainable by mixing polythene with other polymers or by polymerizing ethylene in the presence of other monomers or polymers.

The following polymerizable monomers were used in the 19 examples: vinyl chloride (four examples), vinyl acetate (five examples), vinyl butyrate, vinyl 2-ethyl hexoate, vinylene carbonate, vinyl propionate, acrylonitrile (five examples) and methacrylonitrile. A polythene graft polymer containing 10.7% grafted polyvinyl chloride was injection moulded to form test bars and these had a tensile strength of the order of 1920 psi, and a modulus of elasticity of the order of 20,000 psi. Films made from this graft polymer were transparent and flexible and could be cold-drawn and creased without 'blushing.' The films had good tear resistance.

Thermoplastic Compositions

No. 814, 532. The B. F. Goodrich Co. Application and Filed, October 24 1955. Application in USA, November 2 1954. Published, June 10 1959. A thermoplastic vinyl halide polymer composition comprizes a rigid vinyl halide polymer containing more than 95% polymerized vinyl halide and less than 5% of other monomers copolymerized with it, this polymer being admixed with the following ingredients: (1) a copolymer of styrene and another monomer, preferably acrylonitrile; (2) a rubbery copolymer of butadiene, acrylonitrile and at least one other monomer; (3) a resinous copolymer of a vinyl halide and a vinyl ester. The compositions have extremely high impact resistance and other desirable physical properties as well as the ability to be vacuum-formed without thinning down unevenly or tearing during the vacuum-forming operation.

Typical compositions are made by blending about 100 parts of PVC, about 10 parts of styrene-acrylonitrile copolymer, about 10 parts of a butadiene-acrylonitrile-styrene copolymer and about 5 to 40 parts of a vinyl chloride-vinyl acetate copolymer. The compositions have tensile strengths of about 6,000 psi, flexural strengths of about 12,000 to 13,000 psi, Izod impact values of about 16 and sag temperatures of about 155 to 165°F. Several examples of suitable compositions are given together with data for their physical properties.

Graft Polymers

No. 812,808. Union Carbide Corporation. Application and Filed, April 26 1957. Application in USA, April 30 1956. Published, April 29 1959.

Styrene-acrylonitrile grafted copolymers of polybutadiene are prepared by forming an aqueous latex mixture of polybutadiene and styrene-acrylonitrile copolymer composed predominantly of styrene, incorporating styrene and acrylonitrile monomers in the mixture and then heating the mixture in the presence of a polymerization catalyst of the free radical type. The grafted polybutadiene polymers thus prepared are recovered from the reaction mixture by known means, *e.g.* by coagulation with an acidified aqueous salt solution. Unlike similar prior grafted polymers, the products of the invention can be readily milled to a smooth sheet.

Export Opportunities

Rubber Thread, Rubberized and Stretch Woven Piece Goods for Israel

The 'Shalev' Investment Corporation Ltd., 3 Haaliyah Street, P.O. Box 1400, Tel Aviv, would like to get in touch with UK suppliers of regular and round irregular uncovered, rubber thread, sizes 32/6 to 50/54, used in the manufacture of elastic web. The company is a subsidiary of Boris Weisbourd, an old-established firm of commission agents, manufacturers' representatives, general importers and exporters.

Suppliers interested in this enquiry should write direct to the 'Shalev' Investment Corporation Ltd., and should notify the Commercial Secretariat, British Embassy, 192 Hayarkon Street, Tel Aviv, that they have done so. B.o.T. reference: ESB/17879/59.

Rubber Sheets for Switzerland

Schaerer A.G., Quellenweg 4-6, Berne, have informed the British Embassy at Berne that they would like to receive offers from UK suppliers of rubber sheets for hospital beds to the following specification: in reels of 90cm. width, 0.4-0.6mm. thickness, colours: red and white. The firm are looking for an especially soft quality for which they believe there would be a considerable demand in Switzerland. Schaerer A.G. are old established manufacturers of medical, surgical and other instruments, equipment for hospitals and dairies, and have branches at Lausanne, Zurich, Basle and Geneva.

Suppliers interested in this enquiry should write, enclosing offers and samples, direct to Schaerer A.G., and should notify the Commercial Department, British Embassy, Willadingweg 83, Berne, that they have done so. B.o.T. reference: ESB/23332/59.

Raw Materials for South Africa

Leo Raphaely and Sons, P.O. Box 447, Cape Town, have informed the United Kingdom Trade Commissioner at Cape Town that they are interested in representing United Kingdom manufacturers of prime raw materials for the plastics industry.

Leo Raphaely and Sons have branch offices at Johannesburg, Durban, Port Elizabeth, Bulawayo and Lourenço Marques and offer coverage for the whole of the Union, the Rhodesias and Portuguese East Africa. At the present time they hold 35 United Kingdom agencies for various products.

Manufacturers interested in this agency enquiry should write direct to the Cape Town concern and notify the United Kingdom Trade Commissioner, P.O. Box 1346, Phoenix House, 42 Burg Street, Cape Town, that they have done so. B.o.T. reference: ESB/23155/59.

The address of the Export Services Branch of the Board of Trade is Lacon House, Theobalds Road, London, W.C.1. Telephone number: Chancery 4411, extensions 776 or 866.

Industry INTELLIGENCE

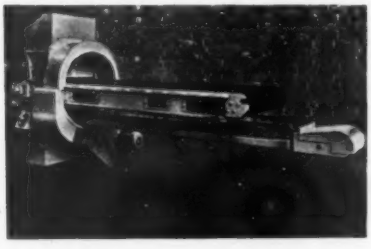
Machines, Materials and Equipment

Electrostatic Paint Spray

A new electrostatic hand gun allows metal articles to be painted by a technique which is much like normal spray painting, but which offers important advantages and economies. The article to be coated is hung from an earthed conveyor, or other earthed support, and the atomizer of the gun is held at a potential of 90,000 volts. The electrostatic field set up between the gun and the target article causes a powerful attractive force which pulls all the paint particles to the target. Paint which passes the article is pulled back towards its rear surface, giving a 'wrap-around' effect which considerably simplifies work on articles of complex form, such as those made of perforated or expanded metal. As a result of the powerful attraction to the article to be painted, there is no overspray. Paint is practically 100% utilized, and complex spray booth equipment is not needed. The 90,000 volts potential is derived from the mains through a transformer unit, and safety devices protect the operator and prevent discharges which would be dangerous in a solvent laden atmosphere. The paint is fed to the gun by pressure feed or pump, but no compressed air is used for atomization, which is effected by a rotating bell operating in the electrostatic field. The gun is manufactured by Henry W. Peabody (Industrial) Ltd., 17 Great Suffolk Street, London, S.E.1.

Chain Grate Ash Extractor

The recently introduced Riley Automatic Ash Extractor has been developed as a standard item for installation with most sizes of either new or existing Riley Type 'T' Chain Grate Stokers. The extractor is a conveyor type and is designed so that there is very limited wear on the moving parts since the ash is stationary on the apron plates and moves in relation to the conveyor, not in opposition to it as in the case of scraper and drag link conveyors. The conveyor travels at a constant speed of 3½in. per minute and is driven by a separate gear assembly comprising an ½hp geared motor with a reduction of 1440/0.96 rpm and a further gear train with a 3 to 1 reduction, giving a front shaft speed of 0.32 rpm. A spring loaded clutch with the driven half on a splined shaft protects the gear assembly from overload. Provision is made for tensioning the conveyor. A steam cleaning assembly, which is operated for about 15 seconds per week and uses less than 1lb. of steam in the process, is incorporated to remove any fine particles of ash which penetrate to the inside of the extractor. The ash box at the front of the stoker provides for an ash chute to a water trough conveyor, but it can be fitted with a draw-plate for discharging ash into a low trolley or pan with runners attached. The advantage of an automatic ash extractor is that it eliminates the frequent opening of ash doors and thus prevents the ingress of air which



cools the furnace gases and reduces efficiency. Forced draught fans do not have to be stopped while ashing is in progress and there is, of course, a great saving in labour. In plants where automatic control is considered desirable, an ash extractor is the complement of a coal bunker or conveyor for charging the stoker hoppers. Further details may be obtained from Riley (IC) Products Ltd., 19 Woburn Place, London, W.C.1.

Technical Data

Heat-resistant Butyl Rubber Sponge

The use of a soft sponge rubber sheet to support hose during vulcanization in an autoclave prevents the formation of flat spots along the bottom of the hose. The development of a heat-resistant sponge for this purpose forms the subject of Polysar Technical Report No. 8:6B, distributed in the UK by Polymer (UK) Ltd., Walbrook House, Walbrook, London, E.C.4.

The compound was based on Polysar Butyl 400 and was cured with large amounts of curatives of the quinone type. The product was of the closed-cell variety. It was tested for compression deflection before and after ageing according to the following cycle: (1) 1 hour in steam at 300°F. (2) Cool ½ hour at room temperature. (3) 1 hour in air at 300°F. (4) Cool ½ hour at room temperature. (5) Repeat 1, 2, 3 and 4. The initial compression deflection was 16.5 psi for 25% deflection. After 1 cycle, *i.e.* steps 1 to 5 above, the compression deflection was 14.5 psi; after 2 cycles 14.3 psi and after 3 cycles 16.0 psi. These results indicate good resistance to the conditions imposed on the sponge during use in an autoclave and, in practice, the sponge has shown superior performance to a type of sponge previously used.

BRP Moulding Materials

Data Book No. 3, issued by British Resin Products Ltd., Devonshire House, Piccadilly, London, W.1, contains technical data for the following moulding materials: Rockite phenolics, Styron polystyrene, Rigidex rigid polythene, Rockite polyester dough moulding compounds and Tyril styrene-acrylonitrile copolymer.

The 23 grades of Rockite phenolics are classified in 10 categories, namely, general purpose, shock resisting, electrical, heat insulating, heat resisting, rubber filled, alkali resisting, acid resisting, water resisting and an odourless and tasteless type. There are six grades of Styron, five of Rigidex, two of Rockite polyester dough moulding compounds and one grade of Tyril. Many of the grades of Rockite phenolics and of the other materials are available in a range of colours. The data cover such properties as impact strength, cross breaking strength, density, tensile strength, water absorption, power factor and volume resistivity. Uses of the various grades of these moulding materials are indicated.

Publications Received

Plastics Serve Everyman

The theme of the stands of the Distillers Plastics Group of Companies —British Geon Ltd., British Resin Products Ltd., and British Distrene Ltd.— at the International Plastics Exhibition in London in June, was 'Plastics Serve Everyman,' and a 12-page booklet with that title has been issued describing the widespread uses of plastics in modern life. The domestic and industrial applications of synthetic resins and plastics materials are many and varied. The booklet describes some of these uses and underlines the special properties which account for the increasing use of plastics in so many fields. On the domestic side special sections are devoted to furnishing and interior decoration, long playing gramophone records, rainwear, travel goods, refrigerators, kitchen equipment and consumer packaging—each fast-growing outlets for plastics materials. The corrosion resistant properties of plastics are high-lighted in the sections on pipes and pipelines, the chemical industry and industrial packaging. Sections on the use of plastics in the manufacture of foul-weather clothing and mining equipment complete the publication. Copies of the booklet are available free from Information Department, The Distillers Plastics Group, Devonshire House, Piccadilly, London, W.1.

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

MAXYMIT (787,593) For gloves for domestic use (other than bottling gloves). By Maxwell Plastics Ltd., 147 Orford Road, Walthamstow, London, E.17. (Class 21; August 12 1959.)

VULCAN (*Use claimed from the year* 1923. *Section* 12 (2).) (759,556) For carbon black (not being a pigment) used in industry and 759,557 for use as a pigment (Class 2). By Godfrey L. Cabot, Inc. Address for service is c/o Marks and Clerk, 57-58 Lincoln's Inn Fields, London, W.C.2. To be associated with No. 759,557 (4228, 783). (By Consent.) (Class 1; September 9 1959.)

RUBLA (787,045) For synthetic rubber and articles included in Class 17 made therefrom. By Rubber Plastics Ltd., Upper Basildon, near Pangbourne, Berkshire. To be associated with No. 782,127 (4199, 17) and another (Class 17; September 9 1959.)

MARLICA (787,146). For laminations of plastics included in Class 17 and fibrous materials, the plastics predominating. By The Marley Tile Co. Ltd., London Road, Riverhead, Sevenoaks, Kent. (Class 17; September 9 1959.)

Plastics Statistics

AUGUST IMPORTS AND EXPORTS

ACCORDING to the official Trade and Navigation Accounts for August, UK imports of plastics materials during the month amounted to 3,840 tons compared with 2,699 tons in August 1958. The values were £1,450,073 and £920,005, respectively. The major source was Western Germany which sent 1,195 tons worth £425,878. Imports from the United States accounted for 978 (730) tons of the total, valued at £541,483 (£394,119).

Exports of plastics materials during August totalled 12,853 tons, valued at £3,225,161, and compared with 9,107 tons worth £2,438,295. Hong Kong took 1,524 tons, worth £345,401; Australia, 966 tons, £346,623; Sweden, 646 tons, £169,035.

Details of imports of plastics materials during August are as follow:

	Tons	£
Alkyd solid and liquid resins, solutions, emulsions and dispersions	137	26,342
Cellulose plastics:		
Photographic (including cinematograph) film base (except acetate butyrate)	155	185,716
All other	162	126,309
Polyvinyl chloride:		
Polymers and copolymers	1,059	186,754
All other	311	141,149
All other	2,013	783,803
Total	3,837	1,450,073

Exports of plastics materials in August, with values, were as follow:

	Tons	£
Acrylic sheet, rod, tube, film, foil and profile shapes in primary form	428	265,553
Aminoplastics:		
Solid and liquid resins, including solutions	846	109,102
Moulding and extrusion compounds	490	90,236
Cellulose plastics:		
Moulding and extrusion compounds	278	82,887
Sheet, rod, tube, film (excluding regenerated cellulose), foil and profile shapes in primary form	96	66,294
Phenolics and cresylics:		
Solid and liquid resins (straight and modified)	580	127,225
Other	485	153,874
Polystyrene	1,136	253,824
Polythene sheet, rod, tube, film, foil and profile shapes in primary form	176	57,199
Polyvinyl chloride:		
Polymers and copolymers	1,194	168,605
Moulding and extrusion compounds	945	191,834
Sheet	399	168,800
Other	48	16,361
All other	5,061	1,395,178
Waste and scrap	746	78,189
Total	12,908	3,225,161

BOOK REVIEW

ELSEVIER'S RUBBER DICTIONARY.—Staff of the Rubber Stichting, Delft, Holland (Elsevier Publishing Co., Amsterdam, distributed in USA and UK by D. Van Nostrand Co. Ltd. Price £15 15s.)

Very nearly 8,000 terms relating to rubber, each appearing in ten languages, are contained in this remarkably compact volume. The basic word list is in English, with each term numbered, and is arranged alphabetically, with a useful and clear distinction between British and American usage. Corresponding terms in the other nine languages are arranged horizontally across two pages. The languages covered, besides English, are: French, Spanish, Italian, Portuguese, German, Dutch, Swedish, Indonesian and Japanese (Romanized script).

The second part of the dictionary contains alphabetical lists grouped under each language and a numerical key referring to the basic English table. It gives, wherever possible, the chemical names and formulae, trade names and properties of the materials described which include, for instance, accelerators, activators, antioxidants, blowing agents and so on down to vulcanizing agents.

It is difficult to over-stress the value of this outstanding publication especially when it is borne in mind that, owing to the tremendous advances made of recent years in the fields of science and technology, a number of technical dictionaries are in some respects out of date. Added to which an increasing number of languages must now be covered to keep track of developments. In this respect, and it appears the book's only defect, it is unfortunate that Russian, now one of the world's most important technical languages, is not included.

However, the dictionary will prove of the utmost value to all those working in all aspects of the rubber industry whether in field, factory, office or laboratory, and equally so to many others, engineers, chemists, botanists, geologists, on the fringe of or outside the rubber industry. The compilers are to be congratulated on an exc[illegible]

∴ Copies may be ordered through the Books Department, RUBBER JOURNAL AND INTERNATIONAL PLASTICS, Maclaren House, 131 Great Suffolk Street, London, S.E.1.

Viton Price Down

The price of Viton synthetic rubber has been reduced by 32s. per lb., it has been announced by Du Pont Co. (United Kingdom) Ltd. This product will now sell for 88s. per lb.

Rubber market reports have been unavoidably omitted from this issue which closed for press earlier than usual. The reports and prices will be resumed in next week's issue.

Rotoplas Ltd. (632,962).—July 17. Capital: £200 in £1 shares. To carry on the business of plastics manufacturers and processors, iron masters founders and workers, etc. The directors are: Arthur A. Robson, 42 Winsham Grove, Battersea, S.W.11; Stanley J. Mackie, 38 Bucharest Road, Wandsworth, S.W.18. Regd. office: 2a Sugden Road, Battersea, London, S.W.11.

Real Plastic and Plywood Supplies Ltd. (630,510).—June 16. Capital: £1,000 in £1 shares. To carry on the business of retailers, wholesalers, merchants and dealers in plastic, wood and timber, etc. The directors are: Abraham A. Lawrence, 119 Hendon Way, London, N.W.2, and Audrey E. Emanuel, 'Galteemore,' Tongdene Road, Hove. Regd. office: 77 Portland-place, London, W.1.

New Companies

Rubber Journal and International Plastics CLASSIFIED ADVERTISEMENTS

APPOINTMENTS VACANT

6d. a word, Minimum 10/-. Box 2/-.

CHEMIST required with experience in compounding natural and synthetics and of process control. Several years' experience and A.I.R.I. or equivalent preferred.—Applications marked confidential should give full details of education and experience, to Managing Director, Long and Hambly, High Wycombe, Bucks. (240)

FLOORING technologist required for development work on Vinyl flooring by public company situated north of Manchester. Applicants must have wide experience in this field.—Apply in confidence, giving details of age, experience, education and salary required to Box 225. (225)

PRODUCTION controller (with responsibility for quality control). I.T.S. Rubber Limited, Petersfield, Hants, have this new appointment for a man experienced in production control procedures. Preference will be given to applicants having knowledge of inspection and management techniques. Experience in the rubber industry will also be an advantage. The successful applicant will be a keen man, able to fit into the management team, which is engaged in re-organizing production methods. Candidates should be in the 25-40 age group and will be offered a position which is permanent, pensionable and will carry a good salary. Assistance may be given in connection with housing if necessary.—Write in confidence, giving brief details of career and present salary to the Works Manager, ref.: APO/JWW. (245)

A LARGE progressive company manufacturing a wide range of mechanical products requires a qualified technologist of A.I.R.I. standard or equivalent with experience of rubber compounding. Candidates, 30-40, must be able to work on own initiative, have experience in the development of projects and be able to control technical staff. An attractive salary will be offered in line with the responsibility involved. Assistance with removal expenses in addition to contributory superannuation, and free life assurance will be given.—Applications giving full details of age experience, qualifications and present salary should be sent to Box 247. (247)

APPOINTMENTS VACANT

(continued)

PRODUCTION planning office of electric cable manufacturers in London district require a keen young man, preferably with knowledge of rubber and plastic cable making processes, to develop planning.—Write stating age, experience and salary required to Independent Consultants Ltd., 22 Stafford Road, Ellesmere Park, Manchester. (246)

MILL-ROOM foreman for works making high-grade floorings, sheetings, soling materials, etc. Pension scheme, canteen.—Rubberware Limited, Bell Works, Harefield, Middlesex. Telephone: Harefield 2123. (241)

RUBBER technologists. A vacancy exists for a senior technologist in a department producing rubber transmission and "V" belts. Applicants who must have experience in the rubber industry, although not necessarily concerned with belting, should possess a degree or technical qualifications at L.I.R.I. level or equivalent. This is a responsible and interesting post, with a progressive company, and applications should be addressed to:—The Personnel Manager, Turner Brothers Asbestos Company Limited, Leigh Road, Hindley Green, Nr. Wigan. (242)

WANTED. Rubber technician, wishing to better his position, apply immediately for existing vacancy in rubber moulding department of well-known London engineering firm. Permanent staff position, good working conditions, only men with sound practical experience in rubber to metal bonding able to take direct charge of labour, production control and costing need apply.—Write full details, in strict confidence, to Box A348, care of Central News Ltd., Pemberton House, East Harding Street, London, E.C.4. (251)

AGENCIES and REPRESENTATIVES

6d. a word, Minimum 12/6 Box 2/-

VITAFOAM LIMITED require the services of a full-time representative for the Midland area. Applicants should have established contacts with the Upholstery trade in this area.—Reply in confidence giving particulars of age, experience, etc., to the Upholstery Sales Manager, Vitafoam Limited, Don Mill, Don Street, Middleton, Nr. Manchester, Lancashire. (229)

ARTICLES WANTED

6d. a word, Minimum 12/6 Box 2/-

HYDRAULIC presses, steam chests about 30in. square. 5-4in. daylights. 24in. ram, 1-ton per square inch, or near specification.—Box 244. (244)

MASSON grinder for grinding and sifting resin rubber to 30s mesh.—Full particulars to Box 248. (248)

ARTICLES WANTED
(continued)

WANTED. Textile testing machine, 1,000lb. capacity. Belting Press 12ft. long. Goose-neck press, 2-daylight, 2ft. 6in. long. Mixing machine for P.V.C. paste, 50lb. capacity. V-belt machines, building, slicing, skiving, flipper covering, mould wrapping and mould loading machines. Steam vulcanising pan, size 6ft. long, 4ft. diameter. Banbury mixer, 5lb. capacity.—Box 231. (231)

BUSINESS OPPORTUNITIES
6d. a word, Minimum £1. Box 2/-.

ESTABLISHED shippers, closely conected with rubber industry and representing leading rubber reclaimers, chemical manufacturers and carbon black producers, offer London buying office services to overseas rubber manufacturers. Credit Terms available.—Box 249. (249)

PATENTS
6d. a word, Minimum £1. Box 2/-.

THE proprietors of Patent No. 754514 for "Improvements in or relating to the Preparation of Vulcanized Natural or Synthetic Rubber Products" and Patent No. 808302 for "Improvements in or relating to Vulcanization of Rubbers" desire to secure commercial exploitation by Licence in the United Kingdom.—Replies to Haseltine Lake and Co., 28 Southampton Buildings, Chancery Lane, London, W.C.2. (237)

PREMISES TO LET
6d. a word, Minimum £1. Box 2/-.

WATERLOO, 22,000 sq. ft. Warehouse or factory premises strongly built on ground and five upper floors. 15-cwt., lift. Good loading entrance and headroom to ground floor. Central heating. Rent: £5,500 p.a., exclusive.—Chamberlain and Willows, 23 Moorgate, E.C.2. (MET 8001). (238)

MISCELLANEOUS
6d. a word, Minimum 12/6 Box 2/-

MANUFACTURERS of roughing machines for rubber sheeting, sponge rubber, splitting machines, leather cloth plant, embossing plates and rollers, spreading machines and presses.—G. L. Murphy, Ltd., Imperial Works, Menston, Nr. Leeds. (238R)

SCISSORS ground and set by London cutlers established over 100 years; 48 hours postal service; 1/6 per pair.—J. A. Fowler, 18/22 Bell Street, Edgware Road, London, N.W.1. PAD 1491. (74R)

WE WISH to contact a firm who have calendering capacity for PVC coated fabric. The product would not involve manufacturing for a decorative finish and the quantities involved would be considerable and on a regular basis.—Box 250. (250)

wants! ★★★★★★★★★★★★★★★★★ ***MUST BE PREPAID***

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Maclaren House, 131 Great Suffolk Street, London, S.E.1

ARTICLES FOR SALE (SECONDHAND)
6d. a word, Minimum 12/6 Box 2/-

HYDRAULIC pump, vertical, three throw, 1¾in. diameter 6in. stroke, 1,500lb. per sq. in., driven by 10 h.p. gas motor.—Box 243.

K4 INTERMIX with 110 h.p. drive and conveyor. 84 single geared mill by Bridge, with motor drive. 450-8 8-daylight press by Shaw, platens 36in. x 30in.; 24in. diameter ram.—Reed Brothers (Engineering) Ltd., Replant Works, Woolwich Industrial Estate, London, S.E.18. Telephone: Woolwich 7611/6. (25

ONE twin-daylight vulcanizing press, 36in./40in. square, with or without pump.—Box 236. (23

24IN. MASSON grinding mill with spare discs. V rope pulley. Approximate capacity 200lb. per hour. No motor but can be supplied if required.—Hodson and Co. (Machinery) Ltd., Spring Mills, Tottington, Bury, Telephone: Tott. 123 (23

600

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